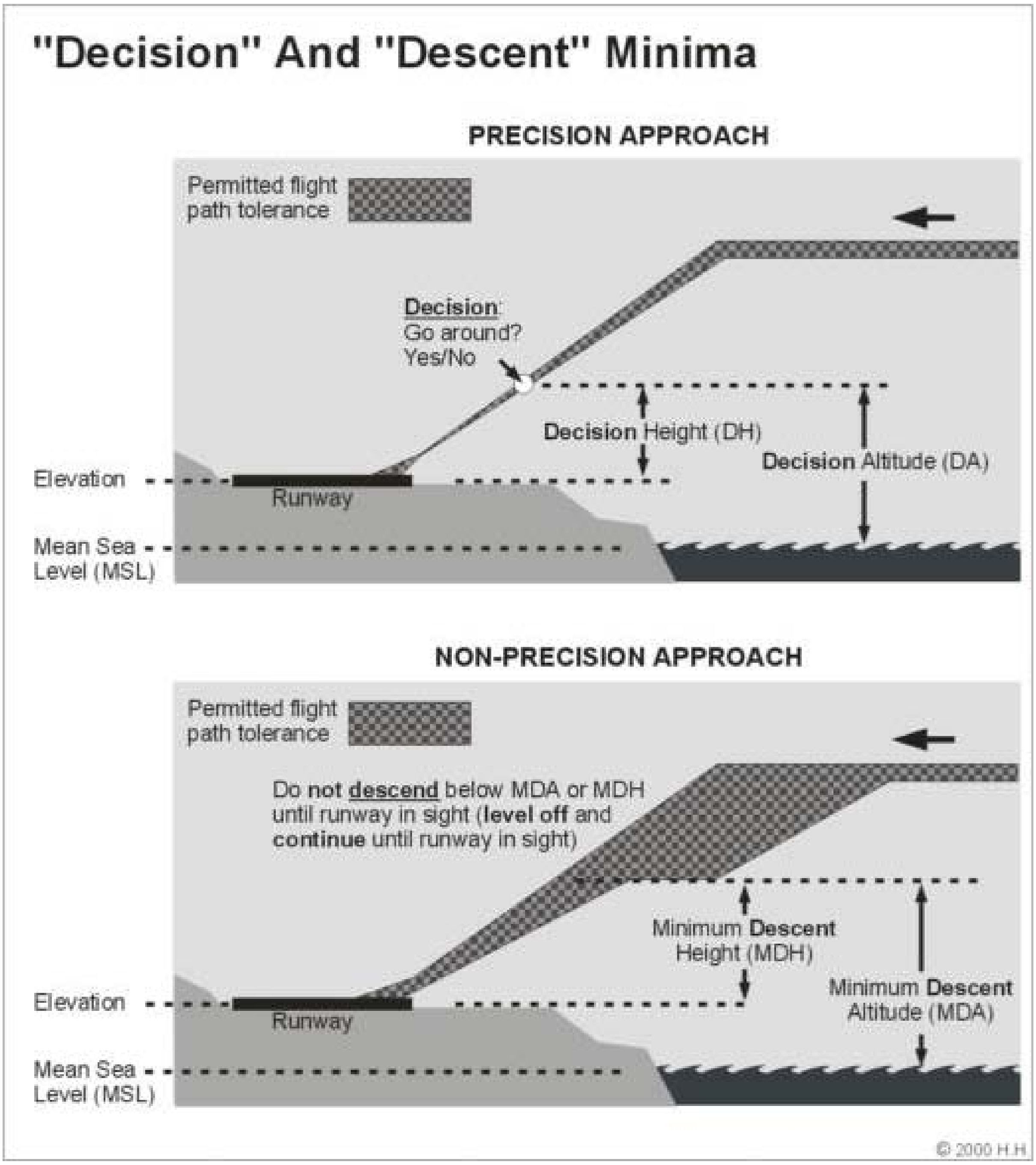
Appendix 1: Decision Height and Minimum Descent Altitude

Hardy has kindly given me permission to include this graphic, which illustrates very clearly the differences between precision and non-precision approaches, and DH vs MDA.


"Decision" And "Descent" Minima
PRECISION APPROACH
Permitted flight path tolerance
Decision: Go around? Yes/No
Decision Height (DH)
Decision Altitude (DA)
Elevation
Runway
Mean Sea Level (MSL)
NON-PRECISION APPROACH
Permitted flight path tolerance
Do not descend below MDA or MDH until runway in sight (level off and continue until runway in sight)
Minimum Descent Height (MDH)
Minimum Descent Altitude (MDA)
Elevation
Runway
Mean Sea Level (MSL)
© 2000 H.H

Appendix 2: Mouse usage

Throughout this page L = left mouse button and R = right mouse button.

Special handling items

Items in this group respond to one or both buttons as follows: L = -1, R = +1, but additionally have an accelerated function: L then add R = -10, R then add L = +10. (This sounds tedious when explained, but you will find that it rapidly becomes intuitive when you use it). Click the left side for the outer ring, right side for inner, and knob itself to push.

The group comprises: **3-function** (Outer ring, Inner ring, and push; **2-function** (turn and push; **1-function** (push only) **knobs** — and also two other types of control:

- **Vertical handles and sliders**: generally, L = up and R = down (*10 with the addition of the other button, as usual)
- **Com radio**: the left window is active and the right is standby — to change, click on the standby MHz and KHz to get the new value, then click the active window to swap.

Other mouse items

- **Fire handles** need to be pulled then turned: click the centre to pull, then left or right of centre for the turn. (See the note on page 25 for a caveat about these).
- **Chronograph**: click to cycle start/stop/reset. (Elapsed time not mousable for safety reasons — use ^Backspace to reset it if required).
- **Nose wheel steering** is accomplished by moving the mouse off the bottom of the page until it disappears, then hold the button and move left or right (releasing the button centres).
- **Instructor page** can be accessed by moving the mouse to the top left hand corner.

Panel selection

- Click on the Nav Display to see the **overhead panel**; to lose it move the mouse off the top or bottom of the panel.
- To select **another overhead panel**, either move the mouse left and right or else click the description at the bottom of the window.
- To select **another glareshield panel**, just move the mouse left or right along the glareshield to reach it.

(See pp 11 to 13 of the PS 1.3 manual for full details of mouse handling).

Appendix 3: SOME IMPORTANT AVIATION TERMINOLOGY

Let's take a few moments to run through a few of those all-important but initially confusing aviation terms. I'm thinking about **altitude** and **height**, **transition altitude** and **transition level**, and **heading** and **track**. The words in each of those pairs sound similar and are used more or less interchangeably in everyday speech, but in an aviation context you are expected to appreciate that their meanings are very specific, and very different.

Altitude, for example, is your height above Mean Sea Level (MSL). If you are crossing the Alps, you could be in a lot of trouble if you confused this with your **Height**, which means Above Ground Level (AGL). This is similar to appreciating the difference between QNH and QNE (see the footnote at the bottom of page 90). Incidentally, 'elevation' is something different again, referring to the height of the airport above MSL (i.e. QFE), but those terms don't really get used in a 747-400 context.

Similarly, when we take off we have local barometric pressure (QNH — or 'altimeter setting' in the U.S.) set for our altimeter, and we will change from that to standard pressure (29.92 inches of mercury or 1013 hectoPascal) at the **Transition Altitude**. Note that in Europe this can be quite low — TA is typically 6,000 ft in the UK, for example, as opposed to 18,000 ft in the U.S. — although I understand that TA can even be as low as 2,000 ft! Up to the TA, altitudes are given in thousands of feet, but once we're above that they are always given as Flight Levels[83] — 25,000 ft is FL 250. When we descend, we change back from standard pressure to the local barometric pressure at **Transition Level** — which obviously also has to be a Flight Level, since as we descend towards it we're working in those units.

Finally, **Heading** is the direction the aircraft nose is pointing, and is indicated by a triangular marker on the ND arc. Since your compass is aligned with the nose of the aircraft, this is what your compass will indicate (we won't get into magnetic variation just at the moment, let alone the difference between magnetic and true, or else this discussion could go on for some time!). However, if the wind is also blowing your aircraft sideways, then obviously the line drawn on the map if you plotted the points the aircraft flew over will not be in the direction shown on your compass: the line on the ground which the aircraft follows is known as the **Track**. (This isn't easy to explain in words — have a look at the diagram on page 109). Different Company configurations vary as to how the information is presented in MAP mode on the ND: some, such as Lufthansa and the British Airways configuration used in the Tutorial, show *heading up* (i.e. pointing vertically up the CRT screen), whilst others show *track up*. Appendix 9 discusses this particular difference in detail. It is important to remember that VOR and APP modes on the ND, and the small compass at the bottom of the PFD, are ALWAYS heading up — "All configs, all airlines", as Hardy affirms. The only difference is that some airlines use track up for MAP mode (only) on the ND. It seems slightly illogical to me, but I'm sure they have their reasons ☺ .

I strongly suggest that you should try and get into the habit of using the terms discussed on this page very precisely: that way, you won't make any mistakes when you find them used in their technical sense in Aviation documents, not least the PS1.3 manual!

---

[83] Hardy adds: "Minima — MSA, MDA, MORA etc.— are never defined as flight levels, since FLs can vary by up to 1000 ft or more depending on the current baro pressure, which could be very dangerous". You will find, for example, that to ensure separation from departing traffic in the Tutorial when arriving at Heathrow, the TL is actually FL70 and not FL60 as you might expect.

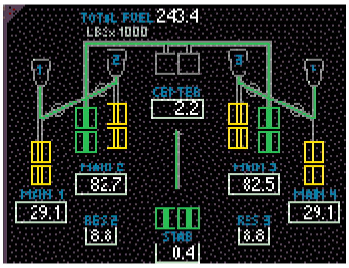
Appendix 4: Fuel management

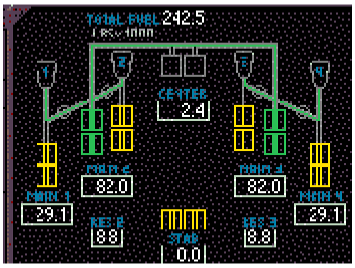
Fuel management on the 747-400 is a complex and highly-automated (by the **F**uel **S**ystem Management Cards) process, and during normal operations there are relatively few occasions when crew intervention is essential. This Appendix aims to summarise those occasions.

First of all, it is necessary to understand the basics. Each engine can (and when the aircraft is light, *will*) be fed from its own tank — Main 1, **2**, **3**, or 4. At higher weights for longer trips, however, fuel is also stored in the reserve wing tanks, the centre tank, and the stabiliser tanks, and these must be depleted in sequence.

Initially with all tanks full, all valve and pump switches should be set O**P**E**N**: when the flaps are not extended the **FS**MCs will open crossfeed valves **2** and **3**.

First to be emptied must be the stabiliser tanks: their pumps are activated by the **FS**MCs to transfer the fuel to the centre tanks once the amount left in the centre tanks is less than 80,000 lbs (see page 185 in the **PS**1 manual for the full logic).

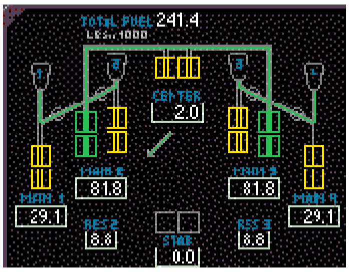


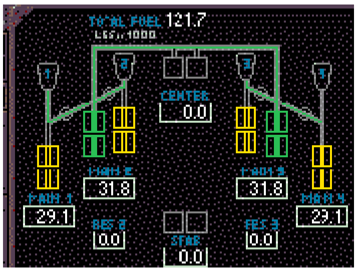


This process continues until such time as the stabiliser tanks are empty, at which point the EICA**S** message **F**UEL **PMP S**TAB appears.

The crew action at this point is straightforward: both stabiliser pumps need to be switched off.

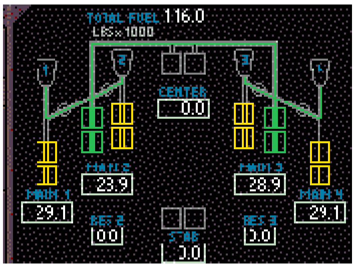
Next to be emptied will be the centre tank: the EICA**S** message here is **F**UEL O**V**RD CTR, and the required action is simply to switch off the centre wing tank pumps. (The **FS**MC's will ensure that override pumps **2** and **3** are activated at this point).

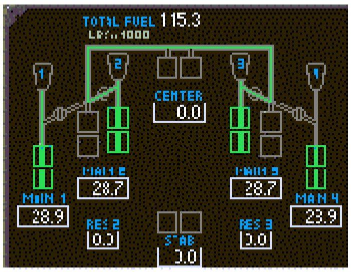




During the next phase of flight, the reserve tanks are emptied and tanks **2** and **3** depleted to the point where they have an equal amount of fuel to that in tanks 1 and 4. Once that is the case, then action is required to ensure that each engine is fed from its own tank (the "tank to engine" condition — the EICA**S** message is "**F**UEL TA**N**K/E**N**G").

In this diagram, the crew (i.e. me ☺) has not responded quickly enough, so that tanks **2** and **3** have now slightly *less* fuel than tanks 1 and 4 — but, either way, the crew actions required are the same — close crossfeeds 1 and 4, and switch off all overrides. My thanks to Hardy, who pointed out that to remove this imbalance it is also necessary to activate "Xfer 1+4" (at the top left-hand corner of the *MISC panel*).





For the rest of the trip, the tank to engine condition will apply.

N.B. The short Glasgow to London trip undertaken as an exercise earlier in this document introduces a special case of the above — on such a tiny hop no fuel is needed in stabiliser or centre tanks, but the use of the A**P**U (perhaps for longer than is normal owing to a crew less familiar with the checklist? ☺) is almost *guaranteed* to ensure that tanks **2** and **3** have less fuel than the others. In this scenario, the 'tank to engine' condition will prevail from the time of engine startup (close crossfeeds 1 and 4, and switch off all overrides) — unless, of course, the external power option was selected so that there was no fuel depletion in tanks **2** and **3**.

Appendix 5: automatic flight and flight modes

There is often some confusion about the relationship between the various automatic flight modes, and also about the way in which you switch from one to the other. This appendix is intended to help ease that confusion a little (!). But be aware that this is probably one of the most complex areas to understand in terms of interactions between the various components, so if you find your eyes glazing over after a paragraph or two — don't worry! It's just the normal reaction the first few times you try to get your head round this stuff ☺ . You will find an excellent summary of all this in your PS1.3 manual on pages 62 and 63.

Let me make one obvious comment right at the start — unless you **check the mode annunciators** at the top of the PFD you can never be sure what mode is engaged! Let's look first of all in the centre of the PFD immediately above the artificial horizon: there you will see the overall AFDS status display annunciator which can have only a relatively small number of values, so we can sort these out now:—

FD	Flight Director ON and Autopilots disengaged.
CMD	Any autopilot is engaged.
LAND3	Autoland is engaged with all three autopilots on the job.
LAND2	As above, but with only two autopilots engaged (this annunication is inhibited below 200 feet in order not to distract the crew during the critical landing phase — i.e. after the decision to land).
NO AUTOLAND	You're doing this landing! Flare and Rollout modes are unavailable.

We can now move on to consider autothrottle, roll, and pitch modes, and their annunciators are above the main display annunicator, i.e. at the top of the PFD. Although it isn't immediately obvious, roll and pitch modes actually have two lines associated with them — the top line upon which you may see the currently *engaged* mode in **green**, and also another line below it which may also display an *armed* mode (i.e. one which is poised to take over from the one currently engaged when a certain set of requirements is met). An armed mode is shown in **white** if present.

So reading from left to right we have the autothrottle, roll mode, and pitch mode annunciators. You control these flight modes largely by means of the AFDS Mode Control Panel on the glareshield, except insofar as they are all interacting with instructions from the FMC.

LNAV and VNAV

As a beginner, you are apt to spend much of your time in these modes. Actually, experienced Captains often do as well (in some flight régimes, anyway), because the tin brain consistently knows what is the optimum from the point of view of engine wear and fuel consumption.

- LNAV (L for Lateral) follows the FMC path for you as far as left and right, i.e. north and south, are concerned. Generally, you automatically cancel LNAV when you select one of the other roll modes, and vice versa (but see below, perhaps especially the "Resume own navigation" section at the end).

- **VN**A**V** (**V** for **V**ertical) sorts out your altitude. In general (again), selecting ALT mode, for example, cancels the **VN**A**V** modes and vice versa, but this is complicated slightly by the fact that there are several **VN**A**V** modes available.

In combination, L**N**A**V** and **VN**A**V** can and will take you most of the places you want to go, as specified by the route in the **F**MC. But occasionally — not least owing to the interventions of Air Traffic Control — you need to override these modes and then return to your path later, and that is where frustration and even despair can set in when people can’t seem to get the mode they need. A description of these other modes is required at this point, and once more this breaks down into left/right and up/down alternatives (but also autothrottle modes as well, as we will see):—

LNAV alternatives (roll modes) (left/right) [CENTRE COLUMN]

Apart from roll mode TO/GA (Take-off /Go-around, used to maintain your ground track when you seriously want to start to get moving upwards) which obviously isn’t engaged other than when you’re near the ground and trying to become less so — and also the LOC IL**S** mode we’ll discuss later on — the chief roll modes to be aware of are the heading modes: HDG **S**EL and HDG HOLD. *Do be very aware of the difference*, since when you are new to all this it’s relatively easy to confuse the two!

> HDG **S**EL maintains the heading you’ve **sel**ected in the *heading window*, and is engaged when you *press the SEL knob*. (This is used to change out of L**N**A**V** mode, for instance).
>
> HDG HOLD **holds** your *present* heading (after it has rolled the wings level, if necessary), and is engaged when you *press the (HDG) HOLD switch*.

These modes are pretty straightforward — but see also LOC mode, below.

VNAV alternatives (pitch modes) (up/down) [RIGHT HAND COLUMN]

These are not so straightforward, since there are several **VN**A**V** modes. They are called pitch modes simply because they alter the aircraft pitch (the extent to which it is nose down or nose up) *in order to achieve the airspeed, or climb rate, or path, which is desired.*

> **P**itch mode TO/GA uses the elevators to command pitch for take-off (if it’s armed whilst on the runway) or it can be engaged to command a Go-Around just prior to landing.
>
> **VN**A**V** **SP**D indicates that the required *airspeed* is to be maintained using the elevators.
>
> **VN**A**V** **P**TH, on the other hand, tells you that the altitude (or the descent *path*) in the **F**MC is to be maintained using the elevators.
>
> **VN**A**V** ALT maintains the *altitude in the MCP window* using the elevators (as, for instance, when the altitude in the MC**P** has been captured whilst **VN**A**V** was engaged).

ALT holds the existing altitude when ALT HOLD is pushed (but see below) — *or else* it maintains the MCP altitude captured following a climb or descent using FLCH or V/S.

"FLCH? V/S? What are they?", I hear you cry. This is where it's time to meet two rather special pitch modes:—

FLCH SPD (as it is annunciated) is engaged when you press the 'FL CH' switch to maintain the *forward* airspeed in the IAS/Mach window during an altitude change. As you may have suspected, it does this by using the elevators to maintain that airspeed: it also changes automatically to ALT mode when the MCP altitude is captured.

V/S maintains the *vertical* airspeed specified in the MCP's V/S window (defaulting at first to the current V/S), and also reverts to ALT once the MCP altitude is captured.

I used to mentally regard these two simply as temporary modes pending a transition to ALT mode, but Hardy has explained to me the very important distinction between them: "FLCH provides 'airspeed protection' — it applies up elevator should the aircraft near either the maximum airspeed limit or the minimum manœuvring speed (the yellow band). *You don't get this airspeed protection with V/S mode*, in which the elevators focus exclusively on vertical speed *regardless of airspeed limits*. Hence the expression 'Filch (FLCH) is your friend'.

Autothrottle modes [84] [LEFT HAND COLUMN]

In this group we have Thrust mode and Speed mode:—

Thrust mode is engaged by pressing the THR switch [85] and comes in two flavours, depending on what mode you are in when the THR switch is pushed. THR REF mode gives you enough thrust to meet whatever thrust limit is displayed on the upper EICAS; whilst THR mode applies sufficient thrust to maintain the commanded vertical airspeed.

---

[84] Be careful not to become confused between the autothrottle modes which control thrust and the other sort of "thrust modes" which are set on the Thrust Lim page and displayed on the upper EICAS (see the table at the bottom of page 158 in the PS1.3 manual for a summary of these).

[85] This mode was the subject of some debate on the Aerowinx board a little while ago, and hence I am able to quote what Hardy said about it then :—
"You need it (the THR button) when you want the autothrottle to keep your thrust exactly at the FMC computed 'reference limit', which is your maximum thrust 'reference' limit if you don't want to hurt the engines. Actually, only in an emergency would you want to push your throttles above this limit. This reference limit is permanently changing. A pilot cannot know the exact numbers from memory, and in the past flight engineers handled the correct thrust setting — nowadays, the computer does this job since the reference limit is permanently changing with the outside air temperature and pressure, and also with the flight phase (i.e. the thrust mode) you're currently in. For example, 'TO' and 'GA' modes allow more thrust for a limited time during take-offs and go-arounds. The 'CON' mode, on the other hand, is a bit lower; however it's allowed continuously without time limits, which is useful when an engine is out and the remaining engines have to be set to the limit. The 'CRZ' mode is the lowest reference limit and the engine's best friend.
The autothrottle may be engaged in THR REF mode:—

- Automatically when you're climbing with FLCH or VNAV or TOGA. In these cases you don't need to push the THR REF button on the MCP. (The button won't illuminate anyway).
- When you want climb power while an AFDS mode other than FLCH or VNAV or TOGA is engaged, or when you want to fly completely without the AFDS. In such cases you would push the 'THR' button on the MCP".

Speed mode (push the SPD switch — the annunciator legend is simply SPD, too) applies sufficient thrust to maintain the commanded forward airspeed.

Note that you can push the knob on the speed selector whenever the speed window is blank — this action will insert your current airspeed, which you can then vary by turning the knob.

But to return to this business of **pushing the ALT knob** to select the existing altitude or the altitude in the MCP window, it all depends what the aircraft is doing when you push it — is it in the cruise, or climbing / descending? And (critically) if cruising, *how near the start of the descent are you*?

- *In a climb or descent*: pushing the knob will delete the next altitude constraint between your current height and that in the MCP window. If you are climbing but no waypoint-related altitude restrictions exist, the altitude in the MCP window is transferred to the FMC.

- *In the cruise but **not** yet within 50 nm of the Top Of Descent*: The current height in the MCP altitude window is transferred to the FMC to become the new cruise altitude. (**Be aware**: if you are in VNAV ALT or VNAV PATH modes then *VNAV* will initiate the necessary climb or descent, but if you are in ALT mode then *you* will have to press FL CH or V/S — to stipulate which is to be maintained, the *forward* airspeed or the *vertical* airspeed).

- *In the cruise and **within** 50 nm of the Top Of Descent*: If the MCP altitude is below the current altitude, the DEScend NOW feature will become active so that the AFDS causes the aircraft to start the descent at 1,250 ft/minute until the VNAV-calculated descent path is intercepted, whereupon it becomes a standard VNAV descent

One final, and rather obvious, comment — you will be *either* be in LNAV *or* HDG modes; similarly *either* VNAV *or* ALT modes. So far, so good — but to make this section complete we need to cover the remaining two switches in this part of the MCP, which are concerned with ILS approaches.

The LOC switch arms or engages the AFDS to capture and track the localizer[86] (the left/right component of the ILS signals, hence this is technically a roll mode): capture can occur providing that the aircraft track is within plus or minus 60° of the localizer course. The current AFDS roll mode (i.e. LNAV or HDG — you're getting the hang of this stuff, now) will remain in effect until capture occurs. "LOC" is displayed on the PFD annunciators in white (and below the currently *engaged* mode in green) whilst it is armed, and then transfers to the top line in green once capture has occurred. To disengage LOC mode before capture, just press the switch again or select any other roll mode: *after* capture has occurred, however, you can only disengage it by engaging a roll mode *other than LNAV*, or pushing the TO/GA switch, or turning off all autopilots and flight directors (if you're completely desperate? ☺).

The APP switch arms or engages the AFDS to capture and track both the localizer *and* the glideslope (the up/down component of the ILS signals). The localizer and glideslope captures are entirely independent events, and theoretically it doesn't matter in which order they occur (although normally you would aim to intercept the localizer first, and then

---

[86] Inbound on the front course.

capture the glideslope as it joins you from above — see the diagram on page 269 of the 1.3 manual: having to descend rapidly to chase the glideslope whilst already close to the ground is a technique which is *not* to be recommended!). The rules for localizer capture are as for LOC, above: notice, though, that to capture the glideslope the aircraft track has to be within plus or minus 40° of the localizer course, which is yet another reason why you tend to try and intercept the localizer first. The annunciator colours are white for armed and green for captured as usual, in both cases. Below 1500 ft AGL, all three autopilots are engaged to participate in the task of tracking the localizer and glideslope (although your airline-specific options may dictate whether all three CMD buttons will illuminate at APP selection OR at 1500 ft).

The rules for disengaging APP mode need to be very clearly understood:—

LOC state	G/S state	Disengage by:—
Armed	Armed	Pushing the APP switch again
Captured	Armed	Select a roll mode other than LNAV
Armed	Captured	Select a pitch mode other than VNAV
Captured	Captured	Push the TO/GA switch or turn off all autopilots and Flight Directors!

"Resume own navigation . . . ."

Finally, some comments about getting back to totally automatic flight — when ATC have finished taking you on a tour of the skies, for example. At such times *just pushing VNAV and LNAV isn't enough* — some knob-twiddling and pushing usually has to be done as well!

- In the case of VNAV you will probably need to reset the MCP window to your cruise altitude and push the button.

- For LNAV you may well have to turn the heading selector to adjust your heading (shown as a *dashed* magenta line on the ND) **until it intersects** your solidly magenta-coloured intended path: on the roll mode annunciators you will then still see HDG SEL (in green, since this mode is still currently engaged) but now with LNAV below it (in white, since it can only be *armed* until such time as it can actually be engaged). Things will sort themselves out once you get back to within a couple of miles of your previously intended route ☺.

- You may also need to push the IAS/MACH selector knob to blank the speed display and allow the FMC to once more take control of your speed.

I really would encourage you to become sufficiently familiar with all this stuff to be able to quickly and confidently apply the correct flight mode (especially in emergency situations): so may I finally offer you (on the next page) a summary table of the modes, which I hope may assist.

AUTOTHROTTLE MODES		ROLL MODES		PITCH MODES	
THR	Maintain thrust to achieve the commanded vertical speed.	HDG SEL	Bank to maintain the heading in the MCP window.	VNAV	*(Armed only):* one of the next three VNAV modes will engage at 400 ft Above Ground Level after take-off.
THR REF	Maintain thrust at the thrust limit as displayed at the top of the upper EICAS.	HDG HOLD	Roll wings level if necessary and maintain resulting (or present) heading.	VNAV SPD	Maintain the FMC or MCP commanded airspeed using the elevators.
IDLE	Throttles are moving to idle; to be followed by HOLD.	TO/GA	Bank to maintain the ground track being followed when this mode was engaged.	VNAV PTH	Maintain the FMC altitude or the VNAV descent path using the elevators.
HOLD	Throttles are disconnected from the servo and may be set manually.	ROLLOUT	*Armed*: will engage below 5 ft radio alt. *Engaged*: Follows runway centreline after touchdown.	VNAV ALT	Maintain the selected MCP altitude (using the elevators) when it is captured whilst under VNAV guidance.
SPD	Apply thrust to maintain the commanded airspeed without exceeding limits (e.g. with VNAV managing a climb / descent to a given speed.	LNAV	*Armed*: will engage at 50 ft AGL after take-off. *Engaged*: bank to follow the active route on the ND (as stored in FMC).	V/S	Use the elevators to maintain the vertical speed selected in the V/S window, switching to ALT mode if an MCP altitude is captured.
		LOC	*Armed*: capture localizer when intercept within +/- 60° of front course. *Engaged*: Follow the localizer track inbound.	TO/GA	Command pitch for take-off or go-around. (Armed on the ground when the 1st F/D is switched on; in the air on capture of the glide slope or flaps not up).
		ATT	(ATTitude hold). In flight after all autopilots and FD's have been off — when the first is switched on, hold the existing bank angle if it's greater than 5°.	FLARE	*Armed*: Engagement at 60 – 40 ft radio alt is announced below 1500 ft (A/P function). *Engaged*: Pitch up to reduce sinkrate: disengage and smoothly lower nose wheel at touchdown.
				G/S	*Armed*: will capture glideslope when intercept track within +/- 40° of front course. *Engaged*: follow ILS glideslope.
				FLCH SPD	Maintain airspeed in IAS/Mach window using elevators: changes to ALT mode when an MCP altitude is captured.
				ALT	*(When ALT HOLD pushed)* maintain existing altitude. *(When captured during FLCH or V/S climb or descent)* maintain selected MCP altitude.

Appendix 6: Creating waypoints, SIDs, STARs, and Approaches

If you have to add your own waypoints to the LEGS page (i.e. just for the current flight — this is *not* the same as permanently adding more navaids and waypoints to your **PS1** database as described on pp **32** - **34** of the **PS1.3** manual), then you will need to follow the usual rules:—

- Press the SHIFT key on your keyboard if the FMC's buttons are not yellow.

- Remember — *use the numeric keypad (KP) for the numbers, when entering the numeric stuff.*

Whilst normally the established VORs and fixes in **PS1**'s database give you plenty of scope to stipulate your route, there are times when you want to temporarily add new waypoints of your own which don't correspond to any existing VOR or fix. In **PS1**, these waypoints are of three types:—

Lat/Long

If — *big* if — you happen to know the latitude and longitude of the point you want to define, just go ahead and enter it, as NDDMM.d/EDDDMM.d or SDDMM.d/WDDDMM.d

- N and E or S and W are mandatory
- DD (DDD in the case of E/W) is the degree portion
- MM is the minutes portion, and
- d is the decimal fraction of the minute

Note that, as with many electronic things that request lat/long information, you only enter a single decimal point in each string — i.e. between minutes and decimal fractions of a minute, but *not* between degrees and minutes.

The whole thing is condensed when it appears in the display, but to see it all simply select the appropriate LSK and it appears in the scratchpad in its full un-truncated glory.

Well that's easy, but in real life relatively unusual — which is why you need the other two.

Place Bearing /Distance

As the name implies, a place bearing/distance (PB/D) point allows you to specify a waypoint in space that is a given distance from a known *navaid or NDB* (but in **PS1** not from an airport, runway, or another waypoint that you have defined) at a given bearing. The format is AAAAAbbb/ccc:—

- AAAAA is the existing waypoint (1 to 5 alphanumerics).
- bbb is the bearing — 0 to 360°, but note that **all three** numerics are *required* for the integer portion of the bearing, so 30° would be represented as 030.
- ccc is the distance — 0 to 999 (integer, in **PS1**) miles:

Once entered, the PB/D waypoint is subsequently displayed as **FFF**nn, where **FFF** is the first three characters of the AAAAA waypoint, and nn is an FMC-assigned sequence number.

An example might be:—

```
GE082/8
```

This indicates a point 8 miles from the GE NDB at a bearing of 82° (as might perhaps be used when heading eastward out of Gatwick's 08R runway).

Please note that "**decimals are not allowed**" with PB/D's or PB/PB's in **PS1**[87] (see also the Examples column on pp 37 and 38 of the **PS1.3** manual for some valid PB/Ds).

Place Bearing/Place Bearing

This defines a point as the intersection of bearings from two waypoints (these are sometimes called "course intersection" waypoints for this reason). These are especially useful if a procedure requires you to follow a radial from one navaid until you intercept a radial of another, but once again in **PS1** there are restrictions — you can't specify bearings from airports, runways, or other waypoints. The other restriction is an obvious one — the courses have to intersect! The format for entering these is fairly straightforward — **PPPPP**iii/QQQQQjjj

- **PPPPP** and QQQQQ are the names of the navaids (up to five characters).
- iii and jjj are the bearings. (A decimal point and following digit are, once again, not allowed in **PS1** as yet — see p. 169 of the **PS1.3** manual where the PB/PB (and other formats) are shown).

As previously, this is shown differently in the FMC as XXX.zz, where XXX is the first three letters of **PPPPP**, and zz is an FMC-assigned sequence number.

The significance of these three waypoint types is twofold in **PS1**: first of all, they can obviously be entered on the LEGS page if ATC should require you to cross a given point or whatever (there are several examples of this sort of thing in the Bulfer and Gifford FMC Guide[88]), but secondly they are a "valid FMC entry" which can be used when creating your own SIDs and STARs (in the .45, .46, .55, .56, .85, .86, or .89 entry types). See the section later in this Appendix for creating your own SIDs, STARs, and Approaches, with an example which will hopefully demonstrate a few basic techniques.

---

[87] That quote in bold type (from the old **PS1.2** FAQs under "Simulator-specific features") continues "**. . . except in PS1's ILS fixes such as .89/RW36/2.5**". So in the example just given, .89 indicates a normal waypoint for an Approach, RW36 is the runway, and 2.5 is the waypoint — situated 2.5 nm from the threshold. (You may also be interested to know that in the case of these ILS fixes you can use negative distances, too). So the absence of decimals is a **PS1**-specific feature. Hardy says: "In **PS1**, decimals are only allowed in combination with a runway centreline when programming a SID or an Approach procedure. Normal PB/D entries with decimals like JFK090.5/12.7 can be entered in the FMC on the real aircraft, but not in **PS1**.

[88] To find out more about how the real FMC works, I recommend the "Big Boeing FMC User's Guide" by Bill Bulfer and Skeet Gifford (be sure you get the latest version). The easiest way is to check out their web site (mail order is available) at: `http://www.firstnethou.com/fmcman/`

Adding speed and altitude restrictions

In the FMC LEGS page you can specify restrictions (constraints) on your speed and height as you cross any given waypoint, and defined constraints appear in large font to the right of the waypoints themselves and on the same line in the FMC display in the format *speed/altitude*. Please note — numbers in small fonts are *FMC predictions, not constraints*, and you usually will want to leave these alone so that the FMC is free to recalculate as conditions change. It is only the entries in large fonts which are constraints entered by the crew (you).

Speed constraints

If you want to enter a speed constraint on its own (i.e. with no altitude constraint) then you have to remember to follow it by a slash so that the FMC knows that you *really* want no altitude constraint. Simply enter 234/ and the FMC will know you want to cross that waypoint at 234 knots. Note that entry of speed constraints and mach numbers on their own is not allowed: you can only have them in conjunction with an altitude constraint [89]:—

Altitude constraints

Simply enter the altitude: 15000 will ensure that you cross at 15,000 ft. You can also use flight levels; there is no need to prefix the numbers with FL, so entering 150 will also ensure that you cross at 15,000 ft. Obviously, this leaves scope for ambiguity, and the rule is that flight levels are two or three numbers, actual heights are four or five numbers (of which the last one is always a zero). When entering low altitudes (usually at the middle or inner markers) you therefore need a leading zero or even two (i.e. 140 would be interpreted as FL140 = 14,000 ft — to enter 140 ft you need to type “0140”; similarly you would enter 80 ft as “0080”).

Altitude constraints mean that you want to cross at *exactly* the specified height — however, you also have the opportunity of specifying a suffix of A or B:—

2500A would mean that you want to cross at or Above 2,500 ft
150B would mean that you want to cross at or Below 15,000 ft

Combined speed and altitude constraints

You can obviously combine the two by entering them together (the altitude constraint follows immediately after the slash terminating the speed constraint) —

865/280A would mean that at the corresponding waypoint you wanted to be flying at Mach 0.865 and to be at 28,000 ft or above. No decimal point is required before Mach numbers, you may notice.

A useful tip — if you have a Speed Limit Point but with no altitude restriction, you can always program it using the desired speed together with an “at or above” altitude constraint that won’t in any way interfere with your likely altitude at that point.

Hardy has helpfully suggested that I should also at this point re-emphasise the firm rule that **you should never enter speed or altitude constraints in waypoints belonging to the cruise**

---

[89] Hardy points out: “If you want to enter a terminal speed constraint without a specific waypoint altitude, you can use the general SPD/ALT line on the VNAV CLB and DES page”.

portion of the flight. Speed and Alt constraints are designed for *departure and arrival procedures only*, and not for the cruise (the real FMC would even return an “INVALID ENTRY” message if you tried!). Neither is there anything here to “confirm” as you do on the PERF INIT and TAKEOFF INIT pages — although trying to do so seems to be a common error amongst beginners — but at least now, gentle reader, *you* will not be numbered amongst those who make that serious mistake. ☺

SIDs, STARs, and Approaches

Check out pages 37 - 40 in the PS1.3 manual for details of how to enter your own SIDs and STARs — but remember that *these are pure PS1 creations*, whereas the normal waypoints as described above and found on the RTE LEGS page are standard (apart from an occasional inability to specify decimal miles or degrees). With a bit of luck, you should be able to find a set of SIDs and STARs for the airport of your choice on the Net — which will save you the trouble of creating them yourself — but if not, then PS1 gives you the tools to make your own.

The creation of SIDs and STARs is, as they say, really beyond the scope of this simple document (and sometimes beyond me), but if you *do* want to get into these arcane activities you can find a very useful set of Tutorials by Joerg Loehnig at `http://www.glideslope.de/tutor.htm`, which supplements the descriptions below and in the PS1 manual.

Most of the information on pages 37 - 40 of the PS1.3 manual is self-explanatory, but there are two points I would like to mention:—

1. When defining a .89 Approach procedure, note the use of the ‘RW28L’ format to indicate runway 28 left (for example): this is very useful in this context, and is used in the two examples at the bottom of page 38 of the PS1.3 manual.

2. “HDG until intercepting COURSE” (e.g. `.81/station/course/heading`) sometimes causes puzzlement. It should be interpreted as “Turn left (or right depending on whether this is x1 or x2) onto a *heading* of yyy° until you intercept and follow the new zzz° *course* (radial) from the specified *station*”. This is a very powerful and useful command, as we will see very soon . . . .

3. Never confuse ‘heading’ with ‘track’ [90], and especially not in this context! “Fly runway heading” (which just means that the nose remains pointed in that direction) is *not* the same as “Fly radial 123” (which is obviously a *fixed* track with respect to the ground). A type .21 or .71, for example, means fly *heading* (regardless of the track, which will obviously depend on the wind at the time) to the given point, whereas a type .49, .59. or .89 mean following the given track regardless of the wind. This is amplified in the four examples given on page 39 of the PS1.3 manual. Note also that page 170 of the manual illustrates how a number of conditional waypoint types appear in the FMC once you have them programmed in.

---

[90] The vitally important difference is discussed on page 73. Also, see Appendix 9 for a discussion of ‘heading up’ versus ‘track up’ in different airline configurations.

An example of SID creation

Supposing we wanted to take off from Glasgow and follow the Dean Cross 7B SID (this is highly unlikely in PS1, since that SID is not to be used by jet aircraft! ☺). The description reads as follows:—

Turn R - 190° - R158 GOW / R338 DCS - DCS.
Cross D14 GOW (D65 DCS): MNM 5000
Cross D19 GOW (D60 DCS): At 6000

That's reasonably clear — after take-off we turn right onto 190° and intercept the 153° radial from the GOW VOR (338° radial from DCS), which we then follow until reaching Dean Cross. We need to be at 5000 ft minimum when 14 nm (DME) from GOW, and to be at exactly 6000 when 19 miles from it. It's not quite the whole story, though — a look at the chart reveals that after take-off we must start our right turn at the GLG NDB, at which point we need to be at a minimum of 2000 ft.

Since this is a SID, we can use types 11 to 49 (page 37 of the PS1.3 manual). Let's start with the first problem — flying straight ahead until we reach GLG, at which point we must be at a minimum of 2000 ft. This is very straightforward — a .49/GLG will take us to the navaid, and adding a 2000A altitude restriction will sort that bit out.

Now let's deal with the right turn onto 190° until we turn left to intercept and then follow the 338° radial to DCS. It sounds complex, but we have exactly the right waypoint type for the purpose. This is a good example of what I was getting at in the second of the three points I made above, which deals with precisely this situation. We need this:— .42/DCS/338/190, which believe it or not, achieves the whole thing. No need for an altitude constraint, because there's two of them coming up.

That just leaves us with the altitude restrictions at 14 and 19 nm from GOW. Once again, these are simply .49 commands, this time with altitude constraints of 5000 and 6000 respectively. So we can enter .49/GOW153/14 with a constraint of 5000 ft, and .49/GOW153/19 with a constraint of 6000 ft. Finally, we round it off with a .49/DCS to get us to the navaid and we're done.

So the whole thing could be economically programmed (from the LEGS page) in just five lines, and we could also save it for any (equally unlikely) future use using the simulator's blue pages.

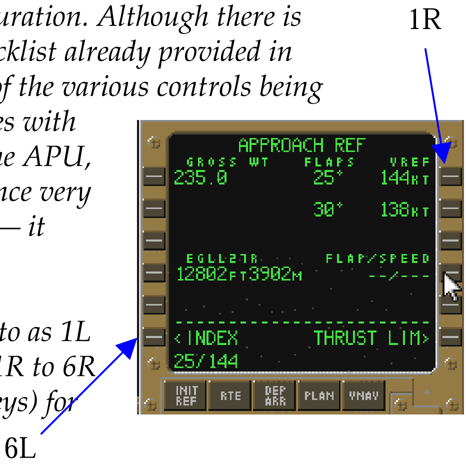
Appendix 7: Checklist Summary for version 1.3a

The previous version of this Tutorial used a synthesis produced from many of the checklists in circulation at that time. However, the 1.3 manual contains two (slightly different) checklists — the one on pp 275-284 (which appears to be largely the version demonstrated in Videos ZZZZZ003 to 10) and also the one implicitly contained in Mel Ott's section starting on page 325. As the old proverb has it "There is more than one way to skin a cat", but this abundance of riches obviously meant that I had to reconsider which version to use, out of those now so readily available.

A proliferation of different lists is undesirable, and so I have abandoned my own previous synthesis. Quite obviously I could add nothing to Mel's splendid and already superbly-commented version, and hence my decision about which to adopt here was a relatively simple one — which also has the huge advantage for beginners that they can use the supplied videos to reinforce the text until such time as they become completely familiar with the procedures.

So, then, this checklist (and the main text) is fairly close to the checklist given on pp 275-284 and as demonstrated in the Videos (although any errors or omissions are, as usual, entirely mine). Please note also that the ***checklist items*** *included here are the Lufthansa ones given in the PS1 manual, which may well not correspond to the ones in use with your Airline configuration. Although there is now no real need for this Appendix (since it is in essence the summary checklist already provided in the manual) the version presented here does additionally give the location of the various controls being discussed, for the benefit of those using it for the first few times; and it copes with the variations introduced by the initial use of external power rather than the APU, and 'quick' as opposed to 'full' IRS alignment. It also rearranges the sequence very slightly so that the doors don't start to open or close before you can watch — it would be a shame to miss Hardy's animation on the DRS synoptic!*

A quick reminder — the Line Select Keys (LSKs) on the CDU are referred to as 1L to 6L (reading down from the top of the column on the left hand side) and 1R to 6R on the right hand side: the keyboard shortcuts are 1 to 6 (above the alpha keys) for the left hand LSKs and F1 to F6 for the right hand LSKs.



Preliminary note (**PS**1-specific)

Before beginning, it is probably a good idea to do everything you need to do from the Instructor's **P**age (I always feel that returning to it afterwards is a bit like cheating). This includes obvious things like loading the appropriate **S**ituation and selecting your favourite options for everything from the weather to details about TCA**S** and ATC, and you may also wish to look at the Airport Info screens for your arrival and departure airports to verify details of runways and IL**S**/comms frequencies. But don't forget whilst you visit the **P**reflight Items menu option (to load your planned amount of fuel) to also note your ZFW (Zero **F**uel Weight) and Centre of Gravity details so that you can enter them into the **F**MC, later. And while you're there, why not add a little spice to life by clicking the "Meet unprepared cockpit" checkbox to let Hardy flip a few switches. (Did I hear someone chuckling....?).

ELECTRICAL overhead panel

BATTERY switch	Set ON (verify 'OFF' lights unlit)
STANDBY power selector	Set to AUTO

HYDRAULICS overhead panel

All four hydraulic demand pump selectors	OFF

MISCELLANEOUS panel

ALTN FLAPS selector	OFF

Main panel

Landing gear lever	Check DOWN (the 'Dn' detent)
Flap lever / flap indicator on the upper EICAS	Check they agree

ELECTRICAL panel

BUS TIE switches	Check all are 'AUTO'

To use the Auxiliary Power Unit		To use External Power	
ELECTRICAL panel —		*ELECTRICAL panel*	
APU selector	On and Start (While it is spooling up, CANCel upper EICAS cautions to await the 'APU RUNNING' message)	EXT PWR 1 and EXT PWR 2	'AVAIL'
		EXT PWR 1 and EXT PWR 2	Switch On
		EXT PWR 1 and EXT PWR 2	Check lights on
'AVAIL' lights	Check Lit		
APU GEN 1	Switch On, check ON now lit and AVAIL light extinguished: pause.		
APU GEN 2	Switch On, check ON now lit and AVAIL light extinguished.		

If full IRS alignment is required	If a quick alignment is sufficient
EEC+IRS overhead panel —	*EEC+IRS overhead panel —*
Ensure all four ELEC ENG CONTROL switches are set to NORM.	Ensure all four ELEC ENG CONTROL switches are set to NORM.
Move L, C, and R switches from OFF to NAV (note that full alignment takes about ten minutes) (Also, be sure to enter your position in the POS INIT page, shortly)	Move L, C, and R switches to ALIGN Enter present position in POS INIT page of FMC Move L, C, and R switches to NAV Ensure IRS ALIGN MODE L/C/R memo messages (on upper EICAS) are removed within 30 seconds

FIRE overhead panel

Fire/eng APU cargo test switch	**Push and hold** until PASS message appears

(Observe the EICAS red "TEST IN PROG" message, and ultimately "FIRE TEST PASS")

MISC panel

EMER LIGHTS switch	Check is ‘ARMED’
FUEL XFER MAIN 1+4 switch	Check is OFF

FIRE panel

Handles (1 - 4 and APU)	In (not rotated or illuminated)
BTL x and APU DISCHarge lights (all)	Not illuminated

ENGINE START + FUEL panel

4 Start switches	IN and not illuminated
Standby ignition (STBY)	NORM
Continuous Ignition (IGNITION CON)	OFF
Auto Ignition switch (AUTO)	NORM (or as appropriate)
Autostart	ON (or as appropriate for airline config)

(Fuel jettison sub-panel)

FUEL JETTISON control selector	OFF.
Fuel jettison nozzle valve switches (L_NOZZLE_R)	OFF
Amber VALVE lights (in the above)	Check neither lit

(Fuel panel)

All fuel pump MAIN and OVRD switches	OFF
8 MAIN fwd and aft pump PRESS lights	All lit (unless the APU is running)
Centre, stabilizer, and override 2 & 3 PRESS lights	All 8 not lit

Glareshield panel

ECS synoptic display switch	Select
OUTFLOW VALVES on lower EICAS	Shown as OPen

MISCELLANEOUS panel

Trim Air	ON
Recirculation fan switches (UPR-RECIRC-LWR)	ON

PNEUMATICS panel

EQUIP COOLING switch	NORM (or OVRD as appropriate for OAT)
HI FLOW switch	OFF

(Bleed air sub-panel)

Pack control selectors 1, 2, and 3	Set to ON (NORM)
Packs’ Reset Switch SYS FAULT light	OFF
L ISLN and R ISLN isolation valve switches	Both OPEN (white bar showing) i.e. ON, and VALVE light extinguished
Engine bleed air switches (4)	ON, and VALVE light extinguished
Engine bleed SYS FAULT lights	Not illuminated
APU bleed air switch	ON
All amber VALVE lights	Verify not lit

Glareshield panel

STATus synoptic display switch	Select

FMC display

(Click on lower CDU or press Tab to bring up the main CDU unit with its buttons).

INIT REF	Push the button
INDEX (LSK 6L)	Select
IDENT page (LSK 1L)	Select
Details on page	Check (especially engine type)
POS INIT page (LSK 6R)	Select

If full IRS alignment is in progress	If a quick alignment was chosen
Downselect last position into scratchpad (LSK 1R) Copy it to the boxes in the SET IRS POS line (4R).	Downselect last position into s/pad (LSK 2R) Copy it to the boxes in the SET IRS POS line (4R).

Check GMT time (UTC)	Check that time at 5L agrees with clock
ROUTE key (LSK 6R)	Select to bring up RTE 1 page
Enter flight number	Type into s/pad and enter via LSK 2R
CDU MENU button	Push the button
ACARS	Select (LSK 2L)
REQUESTS	Select (LSK 1L)
Request the information required	
SEND	Select (LSK 6R)

Dismiss the larger CDU (click on its screen or use Tab).

(PS 1.3 AND full IRS alignment is in progress)	**PS 1.3a (OR PS 1.3 AND a quick alignment was chosen)**
Defer action (1.3 without the 1.3a upgrade-specific).	Set autobrakes to RTO (rejected take-off).

(Below lower right hand side of ND)	
Ground Proximity light	Not lit
Ground Proximity / Flap Override switch	OFF ('OVRD' not shown)
Ground Proximity / Gear Override switch	OFF ('OVRD' not shown)
MISCELLANEOUS panel	
Flap override rotary selector (ALTN FLAPS)	Set to OFF position
ARM switch for Altn Flaps	Not pressed (ALTN not shown)
Alternate gear extend switches	Both OFF (ALTN not shown)
Lower EICAS (STATus display)	
HYDraulic QTY (top 2 lines)	Ensure that magenta 'ReFill' not displayed
Crew and passenger oxygen	Both >=1600 p.s.i.
Lower EICAS status messages	Check acceptable for flight
Comms display	
Set comms to ATIS frequency	Get ATIS (note runway in use, current barometer setting, etc.)
Swap frequencies	Stop ATIS
EFIS control panel (left of glareshield)	
Baro pressure	Set to QNH [91] from ATIS

---

[91] The Q codes date from the days of morse code. QFE is Field elevation Atmospheric Pressure: if your barometer is set to QFE, the altimeter indicates *height above the airport*, but since this is not used on the 747 we can forget about it. The other two *are* used, however: QNH — known in the USA as 'altimeter setting' — is Sea Level Atmospheric Pressure, so if your barometer is set to QNH, the altimeter indicates *height above Mean Sea Level* (i.e. 'Altitude'). The Q you see in METARs (see Appendix 8, starting on page 103) is QNH, so Q1006, for example, indicates a QNH of 1006 hPa. QNE = Sea Level Standard Atmospheric Pressure (1013 mb, 29.92in). If your barometer is set to QNE, the altimeter indicates *Pressure Altitude* ('Flight Level'). But don't confuse any of these with QRH, of course: this is

Large CDU	Select
RTE button	Press
Originating airport	Enter
Destination airport	Enter
Departure runway [92]	Enter
Company Route	Enter (if available)
Route information	Enter from flight plan as required (including DEParture — SID — information)

Activate (LSK 6R) and press the EXECute button

INIT REF button	Press to get PERF INIT page
RESERVES	Enter
COST INDEX	Enter (N.B. up to four figures in 1.3)
CRZ ALT	Enter
NAV RAD button	Press
Check VOR L and R	(Appropriate for current location)
VOR / ADF / ILS frequencies for departure	Set [93]

EFIS control panel (left of glareshield)

Navaids	Set the switches for the L and R VOR or ADF as appropriate
Large CDU	Dismiss

ELECTRICAL panel

L-UTILITY-R utility power switches	Both ON
GEN CONT switches 1, 2, 3, and 4	All ON (amber OFF lights will be present)

HYDRAULICS panel

4 hydraulic engine pump switches (bottom row)	All ON (amber PRESS lights will be lit)
SYS FAULT lights (top row)	All 4 are lit
Pump PRESSure fault lights (second row)	All 4 are lit

MISCELLANEOUS panel

NAVigation Lights	Set ON
Nacelle anti-ice switches	Set to AUTO (acc. to airline config)
Wing anti-ice switches	Set to AUTO (acc. to airline config)
Landing lights	Check all OFF

If this is to be a low-visibility take-off, perform the following indented section once the IRSs are aligned (you will also need to tune the runway localizer in the NAV/RAD page):—

PVD button	Press
EICAS message	Check
PVD button	Press again

---

the Quick Reference Handbook carried on the flightdeck ☺ — the Abnormal Checklists in the PS1.3 manual are just a part of the QRH).

[92] Normally this would be the runway nominated by ATIS. If, however, you have selected the winds to force the use of another runway then ATIS will be innocent of this, and its choice should therefore be disregarded.

[93] Use the Delete key on the 'M' lines if you want to set 'A' (= Autotune).

EFIS control panel (left of glareshield)	
DH display	Remove from PFD (set to below 0 feet)
MDA display	Remove from PFD (set to below -1000 ft)
MDA	Set to [flap acceleration height plus airport elevation] if desired
AFDS MCP (right of the EFIS control panel)	
Left Flight Director switch	Set ON
Autothrottle ARM switch	Set OFF
Bank limit selector	Set AUTO
Heading selector	Set to runway heading
Altitude selector	Set to first waypoint constraint or cruise altitude
Autopilot disengage bar	Toggle to ensure UP (no yellow bar visible)
Control stand	
Speedbrake lever	Set to DN (down)
Parking Brake	As appropriate. (If set, note that >= 800 p.s.i required, and upper EICAS confirms status)
Throttles	CLOSED and reverse thrust levers DOWN
FIRE panel	
Fuel control switches	All at cutoff
(Below PFD centre)	
Stabilizer trim OFF indicator	Check not in view
Comms frequencies	
Radio tuning panel	Set to Ground frequency (or Tower, if Ground doesn't exist).
PFD indications	
"NO V SPD" flag	Displayed (until speeds are set)
Autothrottle annunciator	Blank
Roll mode annunciator	TO/GA displayed
Pitch mode annunciator	TO/GA displayed
AFDS status annunciator	FD
Heading Reference	MAG
Altimeter	Displays airport elevation
ND indications	
No amber flags displayed	Verify
Also displays MAG (top centre)	Verify
Large CDU	Select
INIT REF	Push the button
INDEX (LSK 6L)	Select
POS page (LSK 2L)	Select
Next Page button	Press to go to POS REF 2/2
FMC position & ground speed	Check against L, C, and R IRSs
ROUTE key (LSK 6R)	Press to go to RTE page
Correct runway for take-off	Check
Dismiss large CDU	
Glareshield panel	
STAT synoptic display switch	Select

Lower EICAS Status messages	Check none are displayed [94]

Glareshield panel

FUEL synoptic display switch	Select

ENGINE START AND FUEL panel

Main FUEL PUMPS 1, 2, 3, 4 (both FWD and AFT)	Set ON (PRESS lights should extinguish)

If tank quantity 2 > 1 and 3 > 4 do the following indented line:—

All four crossfeed switches	Set ON

Or, if tank quantity 2 <= 1 (or tank qty 3 <= 4) do the following 3 indented lines instead:

Fuel crossfeed switches 1 and 4 ... Set OFF
Fuel crossfeed switches 2 and 3 ... Set ON
Override pump switches 2 and 3 ... Set OFF

PS 1.3 AND a full IRS alignment has been performed	**PS 1.3a (OR if a quick alignment was done in 1.3)**
Set autobrakes to RTO if not done (PS1.3 specific).	RTO already set — no action required.

Perform the COCKPIT CHECKLIST*:—*

Gear pins	Checked removed
Oxygen	Checked
Altimeters	Set from ATIS
Autobrakes	RTO (Rejected Take Off)
Fuel	Quantity checked as per flight plan
Fuel Control	Cutoff
Passenger Signs	No smoking Auto and (if not deferred [95]) Seatbelts On

[Start of video ZZZZ004]

Large CDU	Select
INIT REF	Push the button to get PERF INIT page
ZFW (see Instructor's page Preflight Items)	Enter from s/pad to LSK 3L
Gross Weight (GR WT)	Confirm (If displayed in small font, press LSK 1L to change it to large font)
THRUST LIM page	Select (6R)
Thrust ratings (including derate if applicable)	Select and check
TAKE-OFF page	Select (6R)
Take-off flap setting	Enter in s/pad and upload to LSK 1L
Take-off V speeds	Push LSKs 1R, 2R, 3R to confirm (i.e. to be in large font)
Check CG	From the figure at the top of the 'Preflight Items' menu option on the Instructor's page
Trim CG	Enter (LSK 4R — the FMC will compute the required stab trim setting (4 - 8 units of trim) [96]. N.B. No decimals — use rounded figure.

---

[94] If any *are* displayed, check the Minimum Equipment List (M.E.L.) to see whether dispatch is allowed with that status.

[95] In PS1 you may wish to defer switching the seatbelt signs on in order to be able to watch the doors closing (very soon, now).

[96] Note that trim is in 'units', whilst C.G. is in percent.

AFDS MCP (glareshield)

IAS/MACH window and PFD repeater	Set to confirmed V2 speed
LNAV switch	Push — check PFD indication (in white)
VNAV switch	Push — check PFD indication (in white)

Dismiss large CDU

- *IF using External Power, follow this (indented) section*

EICAS "STAT" display	Select

ELECTRICAL panel —

APU selector	Start then On
APU AVAIL lights	Check Lit
Push APU GEN 1	Wait a second (automatically disconnects EXT 1)
Push APU GEN 2	Wait a second (automatically disconnects EXT 2)
APU GEN 1 and APU GEN 2	Check lights are On

(This may be a useful point to save your situation . . . .)

ATC pushback and start clearance	Request if required (H key [97]) (and if so, note and enter the squawk using the X key followed by the 0 - 7 keys on the numeric keypad)

HYDRAULIC panel

Hydraulic Demand Pump no. 4	Set to AUX
Other pumps (1, 2, and 3)	Set to AUTO
Parking brake	OFF for pushback, otherwise ON

PNEUMATICS panel

PACKS 1 and 3	Set to OFF
EICAS DRS display	Set

(Below PFD centre)

No Smoking signs	Set to AUTO / ON
Seatbelt signs	Set to ON
Clock	Reset stop watch and elapsed time to zero

MISCELLANEOUS panel

Anti-collision BEACON	Set to BOTH
Upper EICAS caution messages	Remove all (press CANCel switch)

Main panel

Stabiliser Trim	Ensure within the green band for take-off and that the correct units are set
Aileron Trim	Ensure centred at zero
Rudder Trim	Ensure centred at zero

Perform the **BEFORE START** *checklist:—*

Hydraulic Demand Pumps	Aux/Auto.
Autostart switch	On.
Beacon	Both. (*'MISCellaneous' panel*)

---

[97] Note that ATC must be enabled on the Instructor's Page (Text, Sound Blaster, or both)

Packs	1 and 3 OFF, 2 ON.
Parking Brake	ON if no pushback, else OFF.
Take-off Speeds	Checked
Trim (stabilizer; aileron; rudder)	Stab trim within green band; zero; zero.

EICAS DRS display	Check all doors closed and set to Automatic
EICAS secondary ENGine display	Set
Upper EICAS display	Check duct pressures for start

[N.B. With some configurations Autostart is not available — engines need to be started manually[98] *]*

FIRE panel FUEL CONTROL switches 4 and 3	Set to RUN
ENGINE START+FUEL panel ENGINE STARTER switches 4 and 3	Pull
Engine indications on upper and lower EICAS	Monitor during start: — Increasing oil pressure — Rising EGT after approx 15% N2 — Oil pressure and N1 rotation at idle N2
FIRE panel FUEL CONTROL switches 2 and 1	Set to RUN
ENGINE START+FUEL panel ENGINE STARTER switches 2 and 1	Pull
Engine indications on upper and lower EICAS	Monitor during start (as for 4 & 3)
HYDRAULICS panel No. 4 hydraulic demand pump	Set to AUTO
MISCELLANEOUS panel Nacelle anti-ice switches	Set to ON if icing conditions prevail
Off block time	Confirm and note
ELECTRICAL panel APU selector	Set to OFF
PNEUMATICS panel All 3 pack selectors	Set to NORM
EICAS RCL button	Push and check EICAS messages
OIL Qty	Check on lower EICAS
Taxy clearance	Receive

---

[98] The procedure for starting the engines manually is described by Mel Ott on page 337 of the PS1.3 manual. Ensure that the AutoStart switch (if fitted) is in the OFF position, then start the engines one at a time by pulling the start switch, switching the fuel control to Run at 15% N2, and **monitoring** for a normal start as described.

Perform the AFTER START checklist:—

Anti-Ice	ON if icing conditions (otherwise Auto).
Recall	Checked.

[Start of video ZZZZ005]

Taxy area clear	Check
Parking brake	Release
Taxy	Perform
Main panel	
Flaps	Set Flaps as entered in TAKE-OFF REF
EICAS STATus display	Set
Control deflections	Verify
EICAS STATus button	Push to blank lower EICAS
FMC	
VNAV page	Select

Perform the TAXY checklist:—

Flaps	Set (Flaps 10 or as entered into the FMC).
Flight Controls	Checked.
Cabin report	Received (from your virtual CSD)

[Start of video ZZZZ006]

On nearing runway threshold:	STOP — await ATC clearance to proceed
PNEUMATICS panel	
PACKS (1, 2, *and* 3)	Set OFF
MISCELLANEOUS panel	
Inboard and Outboard landing lights	Set ON
Strobe lights	Set ON
Mode Control Panel	
Autothrottle ARM switch	Set ON
Confirm take-off data	Take-off flap setting and thrust rating

Perform the TAKE-OFF checklist:—

Packs	All off
Autothrottle	Armed
Take-off Data	Checked and Confirmed

Lineup clearance received	Turn onto runway, line up, and hold
Take-off clearance received	
"Take-off"	Announce
Brakes	Release
Clocks	Start
Throttles to 70%	Verify engines stable
TO/GA switch	Press (verify throttles move to take-off N1)
PFD annunciating THR REF	Check

Engine indications	Monitor
80 kts	Verify HOLD displayed on PFD
V1 call	Lufthansa “Go”, other airlines “V1”
“Rotate” called	Rotate at 2° per second, ensure < 10° nose up prior to lift-off
Flight Director	Monitor flight path
Landing gear	Retract when positive ROC confirmed: (monitor retraction indications on EICAS).
Autopilot	Activate when required (>= 250 feet)
Climb N1	Check CLB thrust at thrust reduction alt.
PNEUMATICS panel	
Packs 1,2, and 3	Set to NORM (when thrust mode has changed from TO to CLB)
Flap acceleration height	Initiate flap retraction sequence
MISCELLANEOUS panel	
Anti-icing switches	Set to AUTO
Main panel	
When flap retraction completed	Set Gear OFF when gear display disappears
ALTIMETER	Set to STD passing Transition Altitude
Seatbelt signs	Set to AUTO (unless turbulence expected)
Approximately 10,000 feet	
Inboard and Outboard Landing Lights	Set OFF
ATC Radar (Departure)	Contact as required

If you are advised by ATC to "Resume own navigation" then perform whichever actions are appropriate in the following indented section:—

MCP window	Reset next altitude and press button
Heading selector	Adjust heading to intersect FMC course
IAS/MACH selector knob	Push to blank speed display and allow FMC to take control of your speed
FMC LEGS page	Select
RTE DATA>	Select (LSK 6R)
FMC RTE DATA page	Enter known wind data to assist VNAV [99]
VNAV	Monitor PROGress to T/C

[Start of video ZZZZ007]

Cruise altitude	
VNAV page	Check VNAV page CRZ mode indicated [100]
Trim	Re-check when CRZ thrust set
EICAS RCL button	Press and check any indications
Continuous Ignition	As required

---

[99] Do not confuse this procedure with the entry of winds into the DES FORECAST page prior to descent.

[100] (N.B. Depending on the FMC settings, the EICAS thrust limit might not change)

Storm cells	Avoid
EICA**S** fuel messages	Observe and action if required

[**S**tart of video ZZZZ008]

If a step climb becomes necessary, perform the following indented section:—

Permission from ATC	Obtain
S/C green circle on the **N**D	Check
New altitude in MC**P**	Enter and press knob [101]

(PS1 only) Instructor's **P**age options for the descent (if not already set):—

Set ATC requirements:—	
Voices / accents	**S**et as required
Hold **P**robability	**S**et as required
Per text bar / per **S**ound Blaster	**S**et as required
Set F/O requirements:—	
Sets ATC-assigned bugs	Check or clear
Sets Tank-to-Engine	Check or clear
Reference **V**OR / final track	Enter if required
DME vs Altitude information	Enter (from Approach Chart) if required
Escape key	**P**ress to return to the flightdeck

Around 200 nm before the Top of Descent point:—

ATI**S** for destination	Check weather (especially icing conditions), active runway, R**V**R, baro setting.....
Destination barometric pressure	**P**reselect
FMC ARRI**V**AL**S** page	Update as required by the arrival runway, and fix any resulting discontinuities (see below).

If arrival details are not yet entered into the FMC, perform the following indented section:—

FMC DE**P**/ARR button	**P**ress
ARR	**S**elect
Appropriate **S**TAR and/or runway	**S**elect (as indicated by ACAR**S**/ATI**S**)
LEG**S** button	**S**elect
Route to destination	Resolve any discontinuities on LEG**S** page
FMC EXEC button	**P**ress

To compute a more accurate T/D, you need to enter the winds at your destination as received from the ACARS weather report (see the Appendix 8 for details of TAF report formats):—

FMC **VN**A**V** button	**P**ress
DE**S** page	If not currently displayed, use **N**ext (or **P**rev) page to reach it
Descent **F**orecasts page	By pressing L**S**K 5R
Transition Level	Modify if required (**F**L, so 6,000 ft = 060)
TAI altitude	Enter if required (**N**.B. Also changes T/D)
Winds	Enter direction/speed

[**S**tart of video ZZZZ009]

FMC **N**A**V** RAD page	**S**elect
IL**S** frequency and runway heading	Check or enter on **N**A**V** RAD page
Landing altitude (upper EICA**S**)	Check
VNA**V** DE**S** **F**ORECA**S**T page	Check Transition Level

---

[101] The **F**MC (**VN**A**V** CRZ page etc) will be updated automatically.

If CAT II or CAT III landing	Set DH from chart (remove any MDA)
If CAT I or Non-Precision landing	Set MDA from chart (remove any DH)
EICAS RCL button	Press to ensure no messages were missed

Around 50 nm before the Top of Descent point:—

Approach Briefing	Review
Press INIT REF	Enter flap and V_{REF} data for landing weight
PROG 1/2 page	Monitor distance to T/D
Comms	Preset Arrival frequency (Tower standby)
PROGress page	Monitor distance to T/D
Speed restriction information	Enter into VNAV page SPD/RESTR line
Approach briefing	Review

Around 2 – 3 minutes before Top Of Descent point:—

MCP altitude	Reset to altitude at first Alt constraint, or else Outer Marker/Final Approach Fix

Descent

T/D point	Verify autothrottle mode goes from SPD to IDLE then HOLD (flight mode dependent)
VNAV button	Check VNAV DES page is displayed
VNAV deviation pointer	Monitor
Continuous Ignition	Select as required

[Start of video ZZZZ010]

ATC instructions	Obey as received
HOLD page	Enter information as received (check Best Speed line for intended flap setting)
EFIS STD button	Select at Transition Level
Synoptic views	Check
EICAS RCL button	Press: check for previous failures and action as required (noting consequences), then CANCel
Autobrakes	Set as required (1 or 2 on dry runway, 3 or 4 if wet or limited distance: 3 is typical for carbon brakes)
Seatbelt signs	Set to ON
FMC Approach Ref page (INIT REF)	Set flaps 25° or 30° for landing and **note V_{REF}**

Passing 10,000 ft —
MISCELLANEOUS panel

Landing Lights	Set ON

Below 10,000 ft —

Speed	Control as required
Flaps	Extend in line with PFD indications and Company policy: broadly speaking — Flaps 1 V_{REF}30+60 Flaps 5 V_{REF}30+40 Flaps 10 V_{REF}30+20 Flaps 20 V_{REF}30+10 Flaps 25 V_{REF}25 Flaps 30 V_{REF}30
ILS identifier	Check present (~ 20nm from airport)
Initial Approach Fix	Aim for flaps 20, gear up, 175 kts

ALTIMETER	Set to QNH passing Transition Level [102]

Once passed Transition Level:

Barometric pressure	Verify correctly set

Perform the APPROACH checklist:—

Recall	Checked.
Altimeters	Set.
Landing Data	Checked and Confirmed.
Autobrakes	Checked and set.

(N.B. An ILS approach and autoland is assumed here)

ND mode selector (EFIS control panel)	Select APP mode (or remain in MAP)
"Localizer alive" announced	Engage LOC mode on the MCP
LOC mode annunciator on PFD	Check it changes from white (armed) to green (engaged) on capture of LLZ
"Glideslope alive" announced	Engage APP mode on the MCP, select gear down and then landing flaps.
Before reaching the Final Approach Fix	Ensure *fully* configured for approach

Localiser and glideslope both captured

Gear	Down (if not down already)
Flaps	Set to landing position (25° or 30°)
MCP altitude	Set to missed approach altitude
MCP speed	Set to V_{REF} + 0 if autoland, otherwise set to V_{REF} + 5 + (half of headwind component)

If you receive an ATC message ". . . cleared for approach . . . speed . . . call Tower . . ."

MCP speed window	Enter cleared speed
Active comms frequency	Set to Tower frequency

If you receive an ATC message ". . . continue approach, speed at your discretion . . ."

Gear	Down (if not down already)
Flaps	Set flaps 10 (if not 10° or more already)
MCP speed	Set to V_{REF} + 0 if autoland, otherwise
set to	V_{REF} + 5 + (half of headwind
component)	

If you receive an ATC message ". . . turn . . . follow final track to runway . . ."

Heading window	Enter course to intercept localizer at around 20 to 30° at least 7 miles from touchdown.
APP button	Press

Finals

Nacelle and wing anti-ice	Check ON if icing conditions prevail
MCP heading window	Check set to runway heading
MCP speed window	Check set to V_{REF} + 0 if autoland, otherwise V_{REF} + 5 + (half of headwind component)
MCP altitude	Check set for missed approach altitude

---

[102] Depending on the TL, the pressure check and Approach checklist may sometimes be before 10,000 ft (in the U.S., for example) and sometimes after it (e.g. in the U.K).

Speedbrake	Arm
Gear display	Verify gear down and green
Wind direction	Check
PFD announcements	Monitor
(PS1 only) Keyboard	Not in FMC input mode
(PS1 only) Mouse pointer	Poised over TO/GA switch

Perform the FINALS *checklist:—*

Speedbrakes	Armed
Gear	Down
Flaps	Set

Decision height (CAT II or III)

Check runway now in sight	If not, TO/GA, flaps 20, gear, etc.

Landing

Throttles	Idle
Reverse thrust	Apply (monitor REV on EICAS)
Speedbrake extension	Observe (extend if no auto-extension)
80 kts	Disengage reverse thrust
Autobrake performance	Monitor (apply manual braking if required)
Autopilot	Disengage at 30 kts or prior to runway turn-off
Taxy	Perform

Leaving the runway

Autothrottle arm switch	Set to OFF
Speedbrakes	Retract so lever is in the Dn position
Landing lights and strobes	Set OFF *(MISCellaneous panel)*
Weather radar	Set to OFF
Flight Director	Set to OFF
Flaps	Retract fully UP
Stabilizer trim	Set to 6 units

If there is an AFTER LANDING *checklist (e.g. with BA) perform it at this point.*

If the APU is required (for air conditioning after engines are stopped) then do this indented section:

ELECTRICAL panel —

APU selector	Start then On
APU GEN 1 and GEN 2 lights	Check Lit
APU GEN 1 and APU GEN 2	Switch On
APU GEN 1 and APU GEN 2	Lights are On

Parking

Parking brake	Set
Electrical power	Establish (from APU or External power)
Hydraulic Demand Pumps	Off [103] unless leaving aircraft in a "lukewarm" state.
Nacelle and Wing anti-ice switches	Set to AUTO (*MISCellaneous panel*)
Continuous Ignition	Check/Set to OFF
Fuel switches	Set to Cutoff in the sequence 1, 2, 3, 4.
Fuel pump and override switches	Set to OFF (*Engine and fuel panel*)

---

[103] In practice the engine pumps are often left on (unless the aircraft is being totally shut down for some reason) since if the engines are off, the pumps are off.

EICAS DRS display	Select
Beacon	Set to OFF (*MISCellaneous panel).*
Seatbelt sign	Set to OFF
Packs	Set as required (they will currently be ON — *Pneumatics panel*)
Equipment Cooling selector	Check/Set to NORM - *Pneumatics panel*
L and R isolation switches	Check/Set to ON (white bar visible) - *Pneumatics panel*
Brake temperatures	Check distribution is even (GEAR synoptic)
IRS error	Determine (ND map CTR, range 40m, press **POS** switch; press again to remove)
IRS mode selectors	OFF
Exterior lights	All OFF
Emergency lights	OFF

Perform the PARKING checklist:—

IRS selectors	OFF
Fuel Pumps	OFF.
Flaps	Up
Speedbrakes	Retracted (i.e. lever at DN position).
Fuel Control Switches	Cutoff.
Parking Brake	Off.
Emergency Exit lights	Off

N.B. If you want to leave the aircraft in a "lukewarm" state — similar to the one in which you would inherit it from the engineers or the previous flight crew when you arrive on the flight deck — omit the activities below.

Shutdown and leaving the aircraft

PNEUMATICS panel

Pack selectors	Set all three OFF

Electrical panel

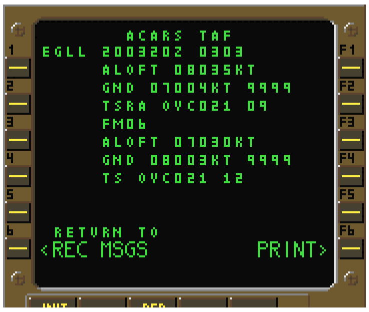
If the APU is still running: APU Selector switch	Set to OFF (then wait two minutes for fire protection)
Standby power selector	Set to OFF
Battery switch	Set to OFF

Perform the LEAVING AIRCRAFT checklist:—

APU/Ext power	OFF
Standby power selector	OFF
Battery	OFF

Appendix 8: METAR (and TAF) mysteries

One difficulty which everyone faces at first when reviewing the results of a weather request is that the response appears to be written in some strange language — or is it algebra, perhaps? The only real solution is to search the web for information about the topic and print it out (a good place for your first stop might be http://www.nws.noaa.gov/oso/oso1/oso12/metar.htm), but meanwhile this Appendix decodes an example, aiming to help take some of the mystery out of the business.



```
        ACARS TAF
EGLL 200320Z 0303
     ALOFT 08035KT
     GND 07004KT 9999
     TSRA OVC021 09
     FM06
     ALOFT 07030KT
     GND 08003KT 9999
     TS OVC021 12

 RETURN TO
<REC MSGS              PRINT>
```

Here is the sort of thing which you might get if you request the weather in London — clear as the proverbial mud, right?

Relax — we have the technology. We can decode it.

Just bear in mind that there is a fixed format for these things, within which various codes are used. Once you begin to recognise the structure, you're half way there!

First of all, know your TAFs from your METARs (look, I didn't invent this, OK? ☺). TAF is an Aerodrome *Forecast* whilst METAR is an Aviation Routine Weather *Report* [104] — and the two obviously tend to include slightly different things So what we have here, the first line informs us, is an ACARS TAF — hence it's a forecast (for EGLL as it tells us on the left of the line below). Let me run through the items one by one — insofar as I understand them, anyway.

`EGLL 200320Z 0303`

Something like this is always at the beginning: the EGLL is obvious enough (always the ICAO code), and the following two groups give the issue time (UTC (Zulu) with a two digit date and a four digit time so this was issued on the 20th of the month at 0320 hrs) followed by the period for which it is valid — normally a two digit date and a four digit time.

`ALOFT 08035KT`

Well, ALOFT is clear enough, but what about the next group? This is simply the wind information: a three digit true north direction (to the nearest 10° — or else the letters **V**a**R**ia**B**le) and the remaining digits are the speed — obviously in kts in this case, although you may encounter MPS. Sometimes, information about Gusts or Variability is appended, with maximum speed and variability range information. So then, winds aloft are anticipated to be 35 kts at 080°.

`GND 07004KT 9999`

At ground level we have an example with no gusts present (note the absence of a letter G): again, the first three digits are the direction (070°), then we have `04KT` — a placid 4 kts. Had this item read `070004G10KT` we would have read it as 4 kts gusting to 10 kts. (Maybe this stuff isn't so bad after all?) Finally, we get the minimum visibility: we have a four digit

---

[104] But (just to confuse things even more) although METARs are for *current* weather, they include SIGMETs, any SIGnificant weather *forecast*.

visibility in meters (in the U.S. they give visibility in statute miles [105]) — so it appears that we will have no problems in that area as we land, anyway. Although not occurring in this example, you sometimes then get information about Runway Visual Range: a two digit runway designator followed by L, R, or C with the RVR usually in meters outside the US (otherwise feet), then a four digit Variability value and a tendency (Up, Down or No change).

`TSRA OVC021 09`
If you consult the table of abbreviations (the ones known to me, anyway) at the end of this Appendix you will discover that TS stands for Thunderstorm, whilst RA is rain. Perhaps the worst will have passed by the time we arrive? OVC means overcast —eight eighths of the sky (yes, all of it) is covered with cloud — whilst the following 021 is the height of the cloud in hundreds of feet, so for us it extends to 2,100 ft. The final 9, in case you hadn't guessed, is the temperature: 9° C. Not exactly warm, but then it is still forecasting for rather early in the morning . . . .

`FM06`
This indicates a significant change FroM the given time (normally four digits). So all the foregoing applied to 0320 hrs whereas at 0600 hrs we have a significant change . . . . The following lines give the details.

`ALOFT 07030KT`
Hmm. They reckon the wind will be dropping slightly to 30 kts, although the direction remains the same at 070°.

`GND 08003KT 9999`
As of 6 a.m. we can expect the wind to come around from 070° to 080° and decrease very slightly to 3 kts, although the visibility remains the same.

`TS OVC021 10`
Ah well, at least the rain will be warming up to 10° . . . .

Perhaps the only thing to add before leaving you with a table of abbreviations is that in cases where you just see numbers separated by a slash — e.g. 12/14 — this is probably the temperature in °C (slash) dew point in °C. If there is an "M" prefixing one or both numbers, then this indicates Minus — below zero.

This is only my own very rough understanding of this topic, so if you find that the table is unsatisfactory or incomplete, why not trawl the web and compile your own? The above, and the table on the next page, have so far been enough to get me by, so I hope they will work as a starting point for you also. (But please feel free to improve on them!).

---

[105] In Europe you get your visibility in meters and your altimeter setting as QNH (if prefaced by a Q — see the footnote on page 90 about Q codes) or hPa ; whereas in the U.S. you receive visibility in units of statute miles (sometimes fractions of statute miles!) and your altimeter setting in in/Hg.

Some useful codes:—

Code	Metar /TAF	Meaning
-		Light
+		Heavy
+FC		Tornado / waterspout
A	METAR	Altimeter setting in inches & hundredths (IIHH)
AUTO	METAR	Automated observation (in the U.S.)
BC		Patches
BECMG	TAF	Becoming (with 2 digit start hour and 2 digit end hour period)
BKN		Broken cloud 5 to 7/8ths cover
BL		Blowing
BR		Mist (>= 5/8 SM)
CB		CumuloNumbus
CLR	METAR	Clear — no cloud below 12,000 ft (automated METAR only)
COR	METAR	Corrected observation (in the U.S.)
DR		Drifting
DS		Dust storm
DZ		Drizzle
FC		Funnel cloud
FEW		Cloud 0 to 2/8ths cover
FG		Fog (< 5/8 SM)
FM		FroM (with two digit hour and minute) start of significant change
FM	TAF	From time (2 digit hour and 2 digit minute start time) of a significant change. On new line indented 5 spaces.
FT		Feet (U.S. — visibility usually in meters elsewhere)
FU		Smoke
FZ		Freezing
G		Gust (wind)
GR		Hail
GS		Small hail or snow pellets
HZ		Haze
IC		Ice crystals
KMH		Kilometers per hour
KT		Knots
METAR	METAR	Hourly report
MI		Shallow
MPS		Meters per second
NSW		No Significant Weather
OU		Widespread dust
OVC		Overcast — 8/8ths cloud cover
PE		Ice pellets
PO		Well developed dust or sand whirls
PR		Partial
PROB	TAF	Probability (with 2 digit percentage) of condition occurring within specified TEMPO (q.v.)
PY		Spray
Q		Altimeter setting (QNH) in hectoPascals (PPPP)
R	METAR	Precedes 2 digit runway designator which is suffixed by 'L', 'R', or 'C' if required
RA		Rain Like other codes, this one is often preceded by other characters: e.g. a plus or a minus (-RA = light rain, +RA = heavy rain) or others (e.g. +SHRA = showers of heavy rain).

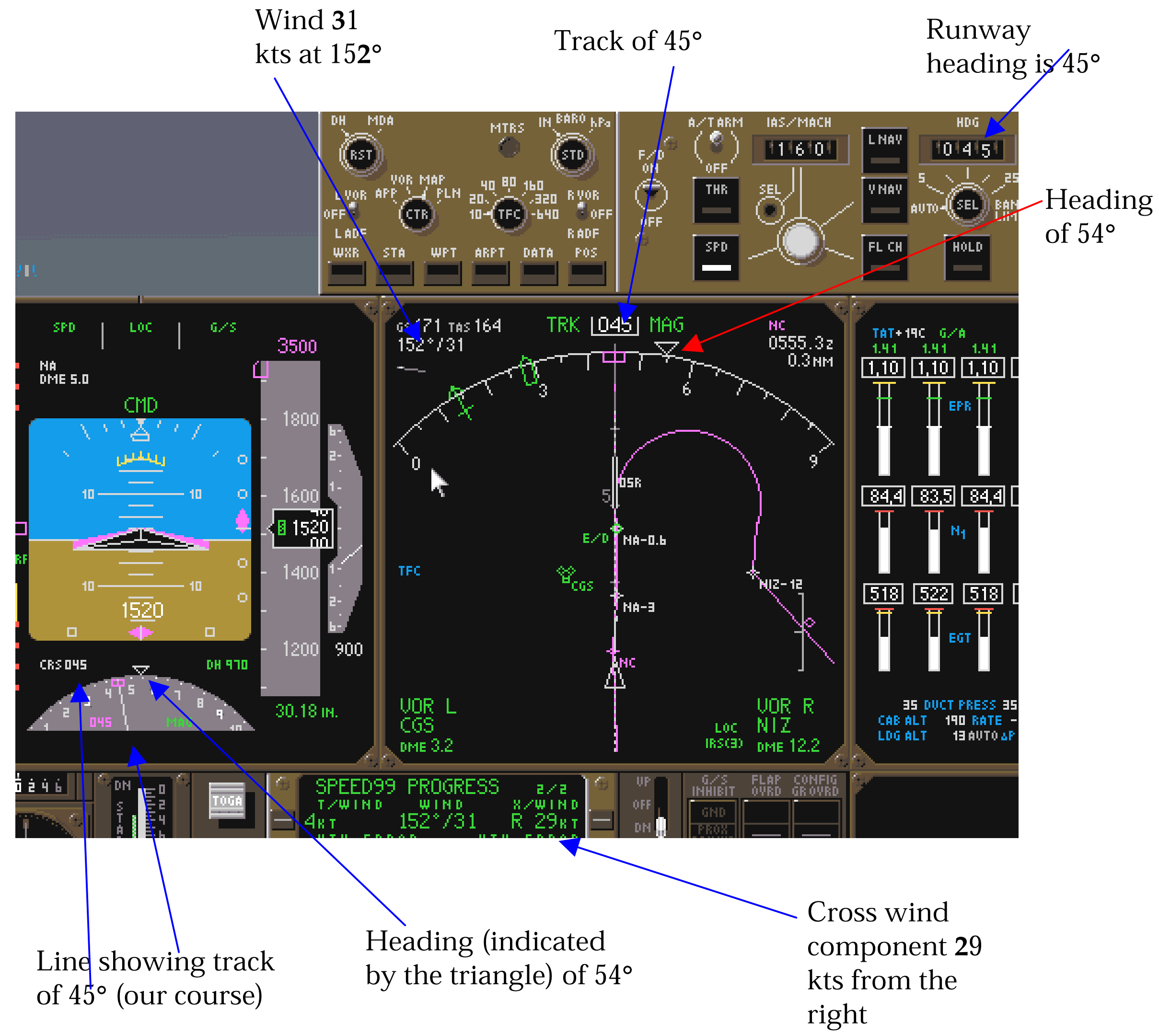
Code	Metar /TA**F**	Meaning
RMK	METAR	Remark
SA		**S**and
SCT		**S**cattered cloud **3** to 4/8ths cover
SG		**S**now grains
SH		**S**howers
SK		**S**ky (clear, no cloud)
SLP	METAR	Three digit **S**ea Level **P**ressure in hecto**P**ascals and tenths (add 1000, so **S**L**P**1**23** means 101**2**.**3** h**P**a)
SM		**S**tatute Miles and fractions of a statute mile (prevailing visibility). If above 6 miles, shown in TA**F** as **P**6**S**M (**P** for **P**lus).
SN		**S**now
SPECI	METAR	**S**pecial report
SQ		**S**quall
SS		**S**andstorm
T	METAR	Temperature and dew point (4 digits each) in tenths °C, so T01**2**60094 is temp 1**2**.6 °C, dew point 9.4 °C.
TA**F**	TA**F**	Routine forecast
TA**F** AMD	TA**F**	Amended forecast
TCU		Towering Cumulus
TEM**P**O	TA**F**	Temporary change (with **2** digit start and **2** digit end time) expected for less than one hour — less than half of start and end period.
TE**S**TM	METAR	**N**on-commissioned A**S**O**S** report
T**S**		Thunderstorm
V	METAR	**V**ariability (wind) — appended to wind direction speed units if direction varies 60° or more — may be suffixed by tendency letter **U**p, **D**own, or **N**o change.
VA		**V**olcanic ash
VC		**V**icinity (not at airport)
VRB		**V**ariable (wind)
VV		**V**ertical **V**isibility
W**S**	TA**F**	Wind **S**hear with **3** digit (100s of ft) height "/" **3** digit wind direction and **2**-**3** digit wind speed above the indicated height, and units (e.g. KT)

Appendix 9: Track up or heading up?

All pilots begin their flying career learning basic principles on light aircraft. Whilst teaching basic airmanship skills, this also inculcates into them the necessity to be continually aware of the effect of wind speed and direction on their flight path, a point seemingly less significant to many flight simmers. The aircraft’s *heading* (the direction the nose is pointed) is only the same as the aircraft’s *track* (the direction of the aircraft’s path relative to the ground) if there is no wind (or if it is from directly ahead or directly behind — in which case the airspeed will still be different from the ground speed).

In **PS**1.**3** the airline configuration which you choose has a very significant effect on many factors, but amongst others it also affects the issue of presentation of data on the **ND**. If you choose to fly with British Airways or Lufthansa, you will have a presentation which is **heading up**, whereas many other airlines use a **track up** presentation. The objective of this Appendix is to illustrate the differences as you would see them when flying an approach to **N**ice 05R, with a rather testing **30** kt crosswind to emphasise the differences (the limit for Autoland is **25** kts!) . . . .

First of all, here is the approach into **N**ice rwy 05R with an airline configuration (**N**orthwest Airlines) which is track up (which may seem at first to be a more intuitive configuration for the non-professional?) **N**ote that we can see through the windscreen that the runway seems somewhat off to the left — because our nose is heading right, into the wind, to keep us on *track*.



Wind **31** kts at 152°

Track of 45°

Runway heading is 45°

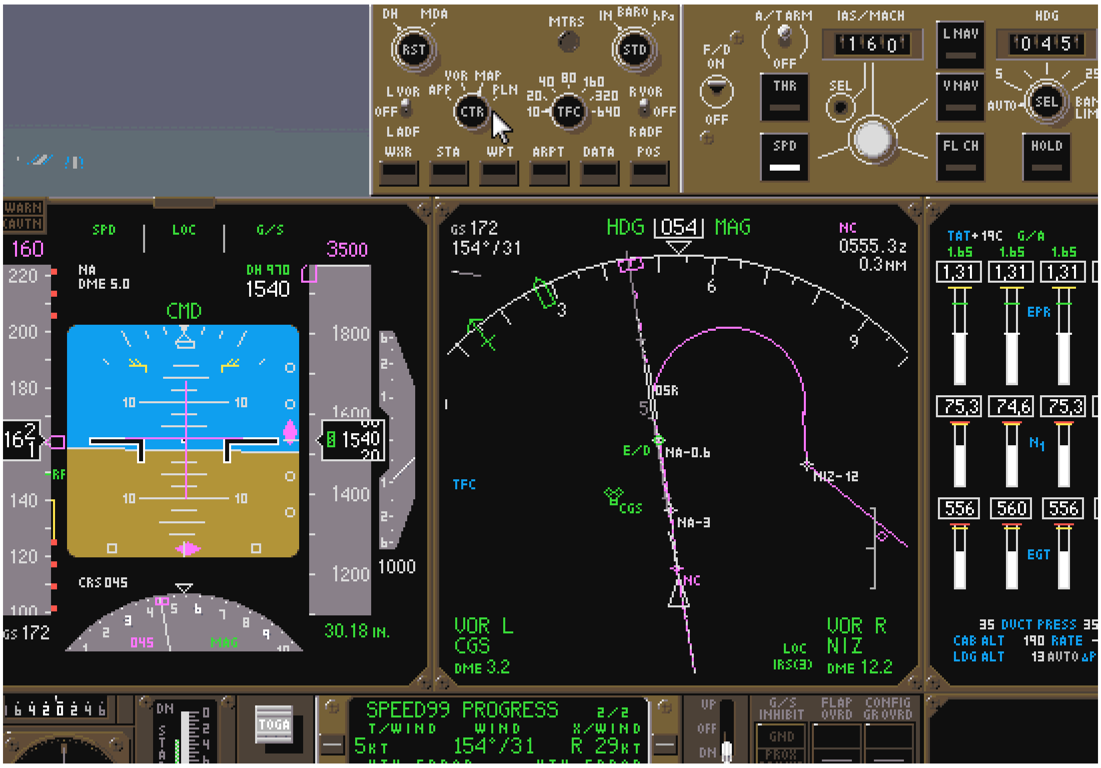
Heading of 54°

Line showing track of 45° (our course)

Heading (indicated by the triangle) of 54°

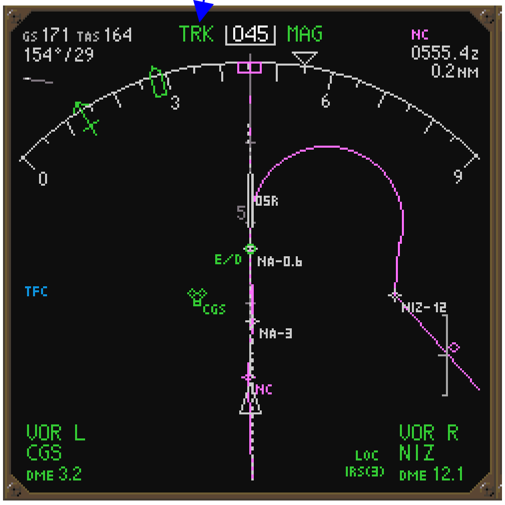
Cross wind component **29** kts from the right

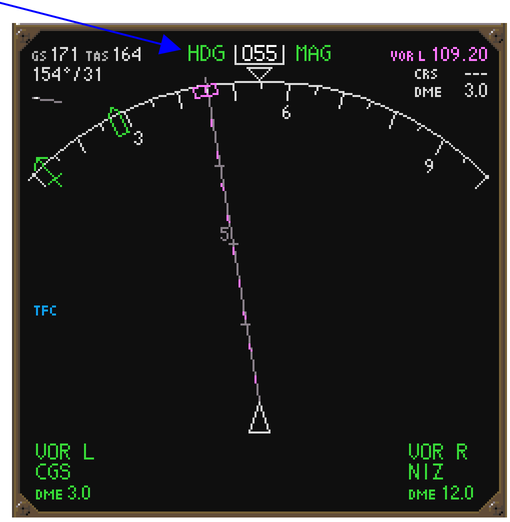
Now here is exactly the same approach, but this time using a British Airways (heading up) configuration. **N**otice the differences on the **N**D, and notice also how this reflects the fact of our right-pointing nose! **S**ince we are now HDG up, the triangular heading marker will always be centralised, and the readout is obviously HDG and not TRK. **N**otice also that the “small” compass on the **PF**D still shows the same readings as previously — it is unaffected by the change in **N**D presentation.



To quote Hardy on this:— “**N**D **V**OR and **N**D A**PP** are always HDG U**P**, in all airlines.... The small compass on the **PF**D is always in HDG U**P**, too”. **S**o, then, if we return to a **N**orthwest airlines configuration and compare MA**P** with **V**OR mode, we should (and do) see a difference:—

The **N**orthwest **N**D is track up, whilst **V**OR mode (and A**PP** mode) remain heading up:—





A little bit of theory

Just for the benefit of those who have never met the mathematics of all this before, here is a very quick and simple sketch of the theoretical basis for the above. (This is fairly basic stuff in any text on applied maths, for those who want to look it up).

Velocity is a *vector quantity* — it requires both a speed *and* a direction to be meaningful. Speed, on the other hand, is a scalar quantity, since the direction is unspecified. Acting on the aircraft in the LNAV sense (we are just looking down on the aircraft from directly above it for the purposes of this discussion) we have the wind, and also the thrust of the engines which will obviously be aligned with the nose of the aircraft, or in other words our heading. The wind is carrying us left of where we want to go, so we need to point the nose slightly right of the runway — with the result that we move along a track *relative to the ground* that happens (hopefully!) to line up with the runway centreline.

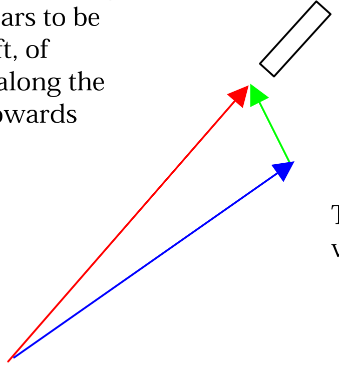
Vectors can also be summed diagrammatically (in a manner sometimes known for reasons which will become obvious as the 'triangle of velocities'), as well as by using trigonometry, so here is a rough diagram (I can't draw it at all exactly owing to a slight lack of drawing tools, but it is roughly in proportion) to try and illustrate what is going on:—

The green arrow represents the wind, coming *from* 152°, and the length of the arrow represents its strength at 31 kts.

When we add to that the blue arrow whose length is proportional to our speed due to the thrust of the engines (161 kts) and whose direction is therefore in the direction our nose is pointing — our heading of 54° — we can see that the resultant of the vector addition of the green and the blue is the red arrow. This shows fairly convincingly that although the nose is pointing slightly right of the target runway (blue arrow), when this is summed with the forces of the wind acting on us the result is that our final track (TRK) relative to the ground (red arrow) remains at 45°, ready to land on the runway [106] — after we have sorted out that crosswind, of course!

You may also notice (from the PROGRESS page in the above diagrams) that there is a slight tailwind component of that wind which will increase our landing speed — i.e. the tailwind component will mean a touch down some 5 kts faster than our indicated airspeed . . . .

The red line is our resultant TRK. Looking along this line, the runway appears to be dead ahead, although the aircraft, of course, will actually be moving along the red line with its nose pointing towards our heading.



When facing our HDG (the blue line), the runway appears to be off to the left.

The green line is the wind velocity

---

[106] In reality, in this particular (and unusual) case, the ILS is offset from the runway by 1.5°, but the principle holds good.

Appendix 10: Flap manœuvring and placard speeds

A few remarks about flap limiting speeds may be useful, since this is a topic that can cause some confusion at first. You may recall that at take-off our flap retraction speeds are based on V_{REF}30 at our take-off weight. It probably comes as no surprise, therefore, that our régime for extending the flaps as we come in to land is based on the V_{REF}30 figure for our *landing* weight (which will usually be very different, depending on how much fuel we have burned since we took off — although in this Tutorial we don’t use much fuel at all for such a short trip, this is extremely unusual for a 747!).

There are two terms that we need to be clear about when using the flaps: the manœuvring speed and the placard speed. Let’s compare and contrast them:—

Flap Manœuvring Speed

This is the minimum recommended speed for a specific flap setting (GREEN indication on the speed indicator).

Hardy adds that if you have reason to expect windshear; or if you are going to use large bank angles; or if your airline stipulates that you should always add 10 knots even in calm conditions; then you should always fly at least 10 knots *above* the current flap manœuvring speed (green indication).

Flap Manœuvring Speeds *vary with the current gross weight*. (Between 190,000 and 390,000 kg gross weight the Manœuvring Speed for flap 20, for example, varies from 134 to 191 knots).

Boeing uses a very “pilot friendly” speed schedule with easy to remember numbers based on V_{REF}30 (‘V_{REF}30’ being the landing reference speed for flap 30 at that weight):

MINIMUM FLAP MANŒUVRING SPEEDS (knots IAS):

Flaps 0 = V_{REF}30 + 80
Flaps 1 = V_{REF}30 + 60
Flaps 5 = V_{REF}30 + 40
Flaps 10 = V_{REF}30 + 20
Flaps 20 = V_{REF}30 + 10
Flaps 25 = V_{REF}25 (derived from performance data base)
Flaps 30 = V_{REF}30 (derived from performance data base)

Example: If V_{REF}30 is 147 knots, then flap 5 manœuvring speed is 187 knots.

Always take the flap manœuvring speeds displayed in green on the right of the speed tape as a guide for when to make flap changes. In the particular case of the approach, as the aircraft slows towards any given flap manœuvre speed (for example, when the green indication for flaps 5 descends towards the point when it will be nearly level with the speed window in the centre of the tape), make sure that you immediately select the next higher flap setting (flap 10). In other words, the figures on the tape are absolute *minima* — having any less flap means that you are heading for a stall, so we always aim for more, taking into account the fact that it takes *time* to extend flaps, most especially from flaps 1 to flaps 5. But there’s nothing to say that you can’t have significantly more flap than the minimum amount

— as long as you don’t exceed the upper limit, which is the placard speed for that flap setting.

Flap placard speed

This is the upper speed limit for a specific flap setting (upper RED band on speed indicator).

Exceeding this speed limit may cause structural damage.

At the most critical flap angles — flap 25 and 30 — the ‘Flap Relief’ system of the 744 automatically retracts the flaps to flap 20 or flap 25 respectively when the speed limit is exceeded.

These speed limits are *always constant*, independent of the current gross weight:

FLAP PLACARD SPEEDS (knots IAS):

Flaps 1 = 280
Flaps 5 = 260
Flaps 10 = 240
Flaps 20 = 230
Flaps 25 = 205
Flaps 30 = 180

So ensure that you don’t extend the flaps if your speed is greater than the maximum *placard* speed for your intended flap setting. You will notice that the flap ‘placard’ speed is significantly higher than its manœuvring speed, giving you plenty of headroom. To take an example, if at a given weight V_{REF}25 for the landing is 148 knots, the placard speed is (a constant) 205 — so you could actually select flaps 25 as soon as you like providing you are at or below 205 knots, which should give you plenty of scope.

With the 747-400, by the way, landings are typically made at flaps 25 — unless weather or runway conditions — or, of course, the standards of your airline — require flaps 30.

---

[107] See the table on p. 159 of the PS1 manual.

Appendix 11: 1.3 manual subject listing

This listing uses the standard abbreviations, including:—

GPWS	Ground Proximity Warning System
CDU	Control Display Unit
TCAS	Traffic Collision Avoidance System
AFDS	Autopilot/Flight Director System (etc.)

Subject	Page	Major section
(Start of section)	291	Abnormal Lists
(Start of section)	5	Acknowledgements
(Start of section)	45	Airplane General
(Start of section)	317	Airport ICAO codes
(Start of section)	53	Automatic Flight
(Start of section)	73	Auxiliary Power
(Start of section)	77	Communications
(Start of section)	3	Contents list
(Start of section)	83	Electrical
(Start of section)	95	Fire Protection
(Start of section)	101	Flight Controls
(Start of section)	109	Flight Instruments
(Start of section)	141	FMC
(Start of section)	183	Fuel System
(Start of section)	189	Hydraulics
(Start of section)	197	Ice Protection
(Start of section)	201	Landing Gear
(Start of section)	239	Limitations
(Start of section)	285	Normal Checklists
(Start of section)	243	Performance
(Start of section)	207	Pneumatics
(Start of section)	217	Power Plant
(Start of section)	265	Procedures
(Start of section)	7	Simulator handling
(Start of section)	29	Simulator Programming
(Start of section)	323	The Inaugural Flight
(Start of section)	225	Warning Systems
+ / - key (CDU)	144	FMC
1-function knob (mouse handling)	11	Simulator handling
2-function knob (mouse handling)	11	Simulator handling
3-function knob (mouse handling)	11	Simulator handling
3-function knob (yellow box)	15	Simulator handling
747APP.INI files	40	Simulator Programming
747FIX.NEW file	33	Simulator Programming
747FIX.TXT file	33	Simulator Programming
747GATE.DB file	35	Simulator Programming
747TRK.PLT file (Analyses)	25	Simulator handling
A/T Arm switch (MCP)	56	Automatic Flight
Abeam key (Fix page)	147	FMC
ABEAM PTS key (LEGS pages)	174	FMC
About menu option	26	Simulator handling
ACARS	80-82	Communications
ACARS line select key (Menu page)	149	FMC
Accelerated fuel flow note	187	Fuel System
Active frequency ind	79	Communications
ACTive page (CDU)	143	FMC
Actual flap positions	106	Flight Controls
Add Malfunctions menu option	23	Simulator handling
ADF L or R fail disp (ND)	126	Flight Instruments
ADF line (left and right) (Nav Radio page)	148	FMC
ADF/VOR switch (EFIS CP)	122	Flight Instruments
Advanced video recording	44	Simulator Programming
Advisory messages (EICAS)	228	Warning Systems

Subject	Page	Major section
AFDS engaged ind (PFD)	112	Flight Instruments
AFDS status	63	Automatic Flight
AFDS status ind (PFD)	61	Automatic Flight
Africa	321	Airport ICAO codes
After landing and parking	284	Procedures
After start checklist	287	Normal Checklists
Aileron lockout (abnormal list)	308	Abnormal Lists
Aileron lockout system	107	Flight Controls
Aileron position (control surfaces) (lower EICAS display)	103	Flight Controls
Aileron trim indicator	104	Flight Controls
Aileron trim switches	104	Flight Controls
Air Traffic Control menu option	24	Simulator handling
Airline configuration (Preferences menu item)	26	Simulator handling
Airline Policy Files (CO DATA line on IDENT page)	154	FMC
Airplane symbol (attitude ind) (PFD)	115	Flight Instruments
Airport database modification	34	Simulator Programming
Airport display switch (EFIS CP)	123	Flight Instruments
Airport Info menu option	25	Simulator handling
Airspeed ind (PFD)	113-114	Flight Instruments
Airspeed indication (PFD)	112	Flight Instruments
Airspeed trend ind (PFD)	114	Flight Instruments
ALIGN (IRS mode)	136	Flight Instruments
Alignment (IRS)	136	Flight Instruments
ALT (pitch mode ind)	63	Automatic Flight
Alt display metric (PFD)	119	Flight Instruments
ALT/OAT line (WINDS pages)	173	FMC
Alternate EFIS/EICAS control	137	Flight Instruments
Alternate EFIS/EICAS control lines (Menu page)	149	FMC
Alternate flaps arm switch (overhead MISC panel)	105	Flight Controls
Alternate flaps selector (overhead MISC panel)	105	Flight Controls
Alternate Gear Extension switches (overhead misc panel)	203	Landing Gear
Alternate mode flap position indication	107	Flight Controls
Alternate stab trim N/A (note)	108	Flight Controls
ALTitiude lines (DESC FCASTS page)	166	FMC
Altitude alert (system logic diagram)	65	Automatic Flight
Altitude and bank angle advisories (GPWS)	235	Warning Systems
ALTitude column (WINDS pages)	173	FMC
Altitude display (PFD)	118	Flight Instruments
Altitude Hold switch (MCP)	59	Automatic Flight
Altitude ind (PFD)	118-119	Flight Instruments
Altitude ind (PFD)	112	Flight Instruments
Altitude loss after take-off or go-around (GPWS)	233	Warning Systems
Altitude manœuvre capability	260	Performance
Altitude profile points (T/C, STEP CLIMB, T/D, E/D)	150	FMC
Altitude selector (MCP)	59	Automatic Flight
Altitude window (MCP)	59	Automatic Flight
Always continue from end (Preferences menu item)	26	Simulator handling
Amber band EGT max cont limit inds (upper EICAS display)	221	Power Plant
Analogue display (radalt) (PFD)	119	Flight Instruments
Annunciators (flight mode) (PFD)	61	Automatic Flight
Anti-ice status inds (wing and nacelle) (upper EICAS display)	220	Power Plant
Antiskid (abnormal list)	313	Abnormal Lists
APF files	154	FMC
APP CTR ND appearance	124	Flight Instruments
APP ND appearance	124	Flight Instruments
APP ND mode (EFIS CP)	122	Flight Instruments
APP switch (MCP)	60	Automatic Flight
Approach (typical PFD)	121	Flight Instruments
Approach (typical)	70	Automatic Flight
Approach checklist	288	Normal Checklists
Approach course ind (PFD)	117	Flight Instruments
Approach keys (DEP/ARR page)	175	FMC

Subject	Page	Major section
APPROACH procedures, creating	37-39	Simulator Programming
APPROACH procedures, saving	40	Simulator Programming
Approach Profile menu option	25	Simulator handling
Approach reference (att ind) (PFD)	117	Flight Instruments
APPROACH REFerence page (FMC)	161	FMC
Approach switch (MCP)	60	Automatic Flight
APPROACHES keys (DEP/ARR page)	175	FMC
APU (abnormal list)	300	Abnormal Lists
APU (general)	75	Auxiliary Power
APU bleed air isolation valve ind (ECS synoptic display)	210	Pneumatics
APU bleed air switch (overhead pneumatics panel)	209	Pneumatics
APU fire bottle discharged light (overhead FIRE panel)	97	Fire Protection
APU fire detector (location)	98	Fire Protection
APU fire extinguishing	98	Fire Protection
APU Fire switch (overhead FIRE panel)	97	Fire Protection
APU Generator switches (overhead ELEC panel)	85	Electrical
APU selector (overhead ELEC panel)	75	Auxiliary Power
APU selector switch (overhead ELEC panel)	85	Electrical
APU shutdown	75	Auxiliary Power
ARM (speedbrake detent)	104	Flight Controls
Armed/Engaged Pitch mode ind (PFD)	61	Automatic Flight
Armed/Engaged Roll mode ind (PFD)	61	Automatic Flight
ARPT ND appearance	124	Flight Instruments
ARPT switch (EFIS CP)	123	Flight Instruments
Arrival menu option	23	Simulator handling
Arrival procedures - removing X-files	40	Simulator Programming
Arrivals / Departures page (FMC)	175	FMC
Assumed temperature ind (upper EICAS display)	220	Power Plant
Assumed temperature select line (THRUST LIM page)	158	FMC
AT line (VNAV CRZ page)	164	FMC
ATC menu option	24	Simulator handling
ATC Transition Level modification	35	Simulator Programming
ATC Transponder	79	Communications
ATC Xpndr code clear and entry keys	79	Communications
ATC Xpndr code window	79	Communications
ATIS reception	81	Communications
ATT (IRS mode)	136	Flight Instruments
ATT (roll mode ind)	62	Automatic Flight
Attitude indicator (PFD)	115-117	Flight Instruments
Aural alerts with cautions messages (EICAS messages)	229	Warning Systems
Australia and Pacific	322	Airport ICAO codes
AUTO (No smoking/Seatbelts selectors)	48	Airplane General
Auto ignition selector (overhead engine start+fuel panel)	219	Power Plant
Autobrakes (abnormal list)	313	Abnormal Lists
Autobrakes selector	204	Landing Gear
Automatic landing limits	242	Limitations
Autopilot Disengage bar (MCP)	55	Automatic Flight
Autopilot disengage switch	64	Automatic Flight
Autopilot Engage command switches (MCP)	55	Automatic Flight
Autopilot engaged limits	241	Limitations
Autostart switch (overhead engine start+fuel panel)	219	Power Plant
Autothrottle Arm switch (MCP)	56	Automatic Flight
Autothrottle disconnect switch	64	Automatic Flight
Autothrottle engaged modes (PFD)	61	Automatic Flight
Autothrottle mode ind (PFD)	61	Automatic Flight
Autothrottle modes	62	Automatic Flight
Autotuning by DELETE of manual ILS entry (NAV RADIO page)	148	FMC
Autotuning ILS entry (NAV RADIO page)	148	FMC
Auxiliary Power Unit (APU)	75	Auxiliary Power
Auxiliary pump inds (hydraulic synoptic display)	192	Hydraulics
Auxiliary pump, second (note)	191	Hydraulics
Back course note	60	Automatic Flight

Subject	Page	Major section
Backups for radio tuning, Xpndr, CDU etc	93	Electrical
Ballast fuel (fuel synoptic display)	184	Fuel System
Ballast fuel line (PERF INIT page)	157	FMC
Bank ind (PFD)	115	Flight Instruments
Bank limit selector (MCP)	58	Automatic Flight
Barber pole (PVD)	136	Flight Instruments
Baro alt setting (current) (PFD)	118	Flight Instruments
Baro control (EFIS control panel)	111	Flight Instruments
Baro line (CDU EFIS control)	137	Flight Instruments
Baro selector (EFIS control panel)	111	Flight Instruments
Baro STD switch (EFIS control panel)	111	Flight Instruments
Barometric descent rates	231	Warning Systems
Battery Charge Status (lower EICAS display)	86	Electrical
Battery Current (lower EICAS display)	86	Electrical
Battery switch (overhead ELEC panel)	85	Electrical
Battery Voltage (lower EICAS display)	86	Electrical
Beacon control (overhead MISC panel)	47	Airplane General
Bearing/distance lines (Fix page)	147	FMC
Before start checklist	287	Normal Checklists
Bell aural alert (EICAS messages)	229	Warning Systems
BEST SPEED line (HOLD page)	178	FMC
Black Box menu option	25	Simulator handling
Bleed air duct pressure ind (upper EICAS display)	211	Pneumatics
Bleed air schematic	212	Pneumatics
Bleed duct leak (abnormal list)	295	Abnormal Lists
Bleed overheat (abnormal list)	296	Abnormal Lists
Blue Pages simulator-specific options	27	Simulator handling
Brake source light	204	Landing Gear
Brake temperature (abnormal list)	313	Abnormal Lists
Brake temperature display (lower EICAS)	205	Landing Gear
Brake/accumulator pressure ind	204	Landing Gear
Bus diagram	87	Electrical
Bus equipment lists	88-91	Electrical
Bus Tie switches (overhead ELEC panel)	85	Electrical
Cabin altitude (abnormal list)	293	Abnormal Lists
Cabin altitude ind (upper EICAS display)	211	Pneumatics
Cabin differential pressure ind (upper EICAS display)	211	Pneumatics
Cabin pressure	241	Limitations
Cabin rate of climb ind (upper EICAS display)	211	Pneumatics
Calculated fuel quantity line (Progress page 2/2)	151	FMC
CALIBRATE JOYSTICK	19, 27	Simulator handling
Cancel switch (EICAS messages)	229	Warning Systems
Cargo compartment and other decks/areas	99	Fire Protection
CAT I	242	Limitations
CAT II	242	Limitations
CAT IIIa	242	Limitations
CAT IIIb	242	Limitations
Caution light (master)	227	Warning Systems
Caution messages (EICAS)	228	Warning Systems
CDU	143	FMC
CDU (keyboard handling)	18	Simulator handling
CDU (mouse handling)	12	Simulator handling
CDU full size key (Tab)	18	Simulator handling
CDU simulator control (shift key)	18	Simulator handling
Centre of Gravity line (TAKE-OFF REF page)	160	FMC
Centre switch (EFIS CP)	122	Flight Instruments
Centre tank pump switches (overhead fuel panel)	183	Fuel System
Checklist (detailed)	275-284	Procedures
Chronograph	134	Flight Instruments
Chronograph (mouse handling)	13	Simulator handling
Chronometer	134	Flight Instruments
Circling approach	273	Procedures

Subject	Page	Major section
CLB 1 line (THRUST LIM page)	158	FMC
CLB 2 line (THRUST LIM page)	158	FMC
CLB DIR key (VNAV CLB page)	163	FMC
CLB line (THRUST LIM page)	158	FMC
CLB page (FMC)	163	FMC
CLEAN CIRCLE line (OFFPATH DES page)	167	FMC
Clear Abnormalities menu option	23	Simulator handling
Clicking FMC keys (Preferences menu item)	26	Simulator handling
Climb (example)	67	Automatic Flight
Climb (typical PFD)	121	Flight Instruments
Climb and cruise	282	Procedures
Clock	134	Flight Instruments
CLR key (CDU)	144	FMC
CMC key (Menu page)	149	FMC
CMD (AFDS status ind)	63	Automatic Flight
CO DATA line (IDENT page)	154	FMC
Cockpit checklist	287	Normal Checklists
CoG line (TAKE-OFF REF page)	160	FMC
COM radio (keyboard)	17	Simulator handling
COM radios (mouse handling)	13	Simulator handling
Command bars (flight director) (PFD)	115	Flight Instruments
Command N1 inds	220	Power Plant
Command speed (PFD)	113	Flight Instruments
Command speed bug (PFD)	113	Flight Instruments
Commanded flap position	106	Flight Controls
Compact displays (note)	93	Electrical
Company Flight Number (Progress page 1 / 2)	150	FMC
Company Route - saving	36	Simulator Programming
Company Route key (FMC)	36	Simulator Programming
Company ROUTE line (OFFPATH DES page)	168	FMC
CON line (THRUST LIM page)	158	FMC
Conditional (floating) waypoints (FMC)	170	FMC
CONFIG FLAPS take-off configuration warning	230	FMC
CONFIG GEAR CTR take-off configuration warning	230	FMC
CONFIG GEAR landing configuration warning	230	FMC
CONFIG PARK BRK take-off configuration warning	230	FMC
CONFIG SPOILERS take-off configuration warning	230	FMC
CONFIG STAB take-off configuration warning	230	FMC
Conflict area above and below (TCAS) (PFD)	116	Flight Instruments
Continue Flight menu option	26	Simulator handling
Continuous engine sound (Preferences menu item)	26	Simulator handling
Continuous ignition switch (overhead engine start+fuel panel)	219	Power Plant
Control Display Unit	143	FMC
Control surface positions (ENG and STAT synoptic displays)	103	Flight Controls
Control surfaces	103	Flight Controls
Co-ords line (Edit Fix)	33	Simulator Programming
Cost Index line (PERF INIT page)	157	FMC
CPU PERFormance (simulator)	27	Simulator handling
Create New Fix LSK	32	Simulator Programming
Create New Video menu option	25	Simulator handling
Creating SID, STAR, Appr procedures	37-39	Simulator Programming
Creating SID/STAR/APPR examples	39	Simulator Programming
Cross bars (FD) (PFD)	115	Flight Instruments
Cross track error line (Progress page 2/2)	151	FMC
Crossfeed valve (fuel synoptic display)	184	Fuel System
Crossfeed valve switches 1 and 4 (overhead fuel panel)	183	Fuel System
Crossfeed valve switches 2 and 3 (overhead fuel panel)	183	Fuel System
CRS ind (approach) (PFD)	117	Flight Instruments
Cruise (typical PFD)	121	Flight Instruments
Cruise centre of gravity line (PERF INIT page)	157	FMC
Cruise FL (ATC simulation)	24	Simulator handling
Cruise WXR 1/2/3 menu options	23	Simulator handling

Subject	Page	Major section
CRZ ALT line (PERF INIT page)	157	FMC
CRZ ALT line (VNAV CLB page)	163	FMC
CRZ ALT line (VNAV CRZ page)	164	FMC
CRZ line (THRUST LIM page)	158	FMC
CRZ page (FMC)	164	FMC
Current airspeed ind (PFD)	113	Flight Instruments
Current altitude display (PFD)	118	Flight Instruments
Current baro alt setting (PFD)	118	Flight Instruments
Current heading pointer (PFD)	120	Flight Instruments
Current Mach ind (PFD)	113	Flight Instruments
Current metric alt display (PFD)	119	Flight Instruments
Cutoff (engine) switches (overhead fire panel)	219	Power Plant
Dashes (CDU)	143	FMC
DATA ND appearance	124	Flight Instruments
DATA switch (EFIS CP)	123	Flight Instruments
Decision Height display (PFD)	119	Flight Instruments
DEL key (CDU)	144	FMC
Deleting conditional waypoints - rules	170	FMC
Demand pump inds (hydraulic synoptic display)	192	Hydraulics
Demand pump low PRESSure lights (overhead hydraulic panel)	191	Hydraulics
Demand pump selectors (overhead hydraulic panel)	191	Hydraulics
DEP ARR key (CDU)	144	FMC
DEP/ARR page (FMC)	175	FMC
Departure / Arrivals page (FMC)	175	FMC
Departure WXR menu option	23	Simulator handling
Derated take-off (SEL line on THRUST LIM page)	158	FMC
DES DIR key (VNAV DES page)	165	FMC
DES KEY (OFFPATH DES page)	167	FMC
DES NOW key (VNAV DES page)	165	FMC
DES page (FMC)	165	FMC
DES TO line (OFFPATH DES page)	167	FMC
Descent (typical PFD)	121	Flight Instruments
Descent (typical)	69	Automatic Flight
Descent and landing	282-283	Procedures
DESCENT FORECASTS page (FMC)	166	FMC
Descent tables	262	Performance
Descent, manual	267	Procedures
DEST line (OFFPATH DES page)	168	FMC
Destination line (Progress page 1 / 2)	150	FMC
Deviation below glideslope (GPWS)	235	Warning Systems
DH display (PFD)	119	Flight Instruments
DH reset switch (EFIS control panel)	111	Flight Instruments
DH/MDA control (EFIS control panel)	111	Flight Instruments
DH/MDA selector (EFIS control panel)	111	Flight Instruments
Direct entry note	179	FMC
DIRect To Waypoint function (FMC)	174	FMC
DISCO (route discontinuity — FMC)	171	FMC
DISPLAY (ND) key (OFFPATH DES page)	167	FMC
Distance and leg direction lines (LEGS page)	169	FMC
Distance To Go (DTG) line (OFFPATH DES page)	167	FMC
Ditching (abnormal list)	315	Abnormal Lists
DME L or R fail ind (ND)	126	Flight Instruments
DME step-down altitude callouts (First Officer menu)	24	Simulator handling
DN (speedbrake detent)	104	Flight Controls
Door status (lower EICAS)	47	Airplane General
Doors (DRS) synoptic switch	47	Airplane General
DOS installation	9	Simulator handling
Downlink (ACARS)	80	Communications
Downslope (WIND/SLOPE line on TAKE-OFF REF page)	159	FMC
DRAG CIRCLE line (OFFPATH DES page)	167	FMC
Drag/FF line (IDENT page)	154	FMC
Drift angle ind (FPV)	117	Flight Instruments

Subject	Page	Major section
Dry runway line (TAKE-OFF REF page)	159	FMC
DTG (Distance To Go) line (OFFPATH DES page)	167	FMC
Duct pressure ind (upper EICAS display)	211	Pneumatics
Duct pressures ind (ECS synoptic display)	210	Pneumatics
E/D AT line (VNAV DES page)	165	FMC
E/O acceleration height line (TAKE-OFF REF page)	159	FMC
ECONomy speed key (VNAV CRZ page)	164	FMC
ECS (pneumatics and air conditioning) synoptic display switch	210	Pneumatics
Edit Airport line (sim internal)	27, 34	Simulator Programming
Edit Fix (Navaid) additional editing	33	Simulator Programming
Edit Fix line	27, 32	Simulator Programming
EEC mode switch (EEC+IRS overhead panel)	222	Power Plant
EFC TIME line (HOLD page)	178	FMC
EFIS control panel	122-123	Flight Instruments
EFIS control panel	111	Flight Instruments
EFIS/EICAS control (alternate - via CDU)	137	Flight Instruments
EFIS/EICAS control lines (alternate) (FMC Menu page)	149	FMC
EGT ind (APU)	75	Auxiliary Power
EGT inds (upper EICAS display)	221	Power Plant
EGT temperature inds (upper EICAS display)	221	Power Plant
EICAS messages	228-229	Warning Systems
Electrical AC bus (abnormal list)	301	Abnormal Lists
Electrical Bus diagram	87	Electrical
Electrical bus isolation (abnormal list)	301	Abnormal Lists
Electrical drive (abnormal list)	302	Abnormal Lists
Electrical generator off (abnormal list)	302	Abnormal Lists
ELECtrical overhead panel	85	Communications
Electrical Synoptic switch	86	Electrical
Electrical utility bus (abnormal list)	302	Abnormal Lists
Electronic Engine Control mode switch (EEC+IRS overhead panel)	222	Power Plant
ELEVATION line (REF NAV DATA page)	162	FMC
Elevators (control surfaces)	103	Flight Controls
Emergency descent (abnormal list)	294	Abnormal Lists
End Of Descent At line (VNAV DES page)	165	FMC
ENG OUT key (VNAV CLB page)	163	FMC
ENG OUT key (VNAV CRZ page)	164	FMC
ENG switch (control surface ind)	103	Flight Controls
ENG synoptic display switch	222	Power Plant
Engaged Autothrottle mode ind (PFD)	61	Automatic Flight
Engaged Pitch mode ind (PFD)	61	Automatic Flight
Engaged Roll mode ind (PFD)	61	Automatic Flight
Engine bleed air switches (overhead pneumatics panel)	209	Pneumatics
Engine bleed air system fault (overhead pneumatics panel)	209	Pneumatics
Engine bleed air valve ind (ECS synoptic display)	210	Pneumatics
Engine driven pump inds (hydraulic synoptic display)	192	Hydraulics
Engine failure / shutdown (abnormal list)	304	Abnormal Lists
Engine Fire Bottle Discharged light (overhead FIRE panel)	97	Fire Protection
Engine fire detector (location)	98	Fire Protection
Engine Fire extinguishing (review)	98	Fire Protection
Engine Fire switch (overhead FIRE panel)	97	Fire Protection
Engine Fire warning light (overhead FIRE panel)	97	Fire Protection
Engine indications (primary)	220-221	Power Plant
Engine indications (secondary)	222	Power Plant
Engine inflight start (abnormal list)	305	Abnormal Lists
Engine oil pressure (abnormal list)	305	Abnormal Lists
Engine oil temperature (abnormal list)	306	Abnormal Lists
Engine pump switches (overhead hydraulic panel)	191	Hydraulics
Engine run switches (overhead fire panel)	219	Power Plant
Engine setting (keyboard)	16	Simulator handling
Engine sound (Preferences menu item)	26	Simulator handling
Engine start switch (overhead engine start+fuel panel)	219	Power Plant
Engine starting	280	Procedures

Subject	Page	Major section
Engines line (IDENT page)	154	FMC
Enroute (typical)	68	Automatic Flight
Enroute climb performance 340/.84	252,253	Performance
Enroute holding	261	Performance
EPR (VNAV CRZ page TARGET THRUST line)	164	FMC
Equipment cooling (abnormal list)	296	Abnormal Lists
Equipment cooling selector (overhead pneumatics panel)	209	Pneumatics
ERASE key (DEP/ARR page)	175	FMC
Erase key (Fix page)	147	FMC
ERROR line (VNAV CLB page)	163	FMC
Estimated Time of Arrival lines (RTE DATA pages)	172	FMC
ET reset switch	134	Flight Instruments
ET/CHR disp	134	Flight Instruments
ETA lines (RTE DATA pages)	172	FMC
ETA/FUEL at destination line (VNAV CRZ page)	164	FMC
Europe East and Russia	320	Airport ICAO codes
Europe West	320	Airport ICAO codes
Examples (creating SID/STARs)	39	Simulator Programming
Excess Data ind (ND)	126	Flight Instruments
Excessive terrain closure rates (GPWS)	232	Warning Systems
EXEC key (CDU)	144	FMC
EXIT HOLD key (HOLD page)	178	FMC
Exterior Lighting controls (overhead MISC panel)	47	Airplane General
External data link	26	Simulator handling
External Power switches (overhead ELEC panel)	85	Electrical
F/D command bars	55	Automatic Flight
F/O menu option	24	Simulator handling
Failure flags (PFD)	112	Flight Instruments
Far East	322	Airport ICAO codes
Fast alignment (IRS)	136	Flight Instruments
Fast changes (keyboard handling)	15	Simulator handling
FD (AFDS status ind)	63	Automatic Flight
Fictitious (“X”) procedures (DEP/ARR) provided with database	40, 175	FMC
Final checklist	288	Normal Checklists
Fire APU (abnormal list)	300	Abnormal Lists
Fire engine or damage (abnormal list)	303	Abnormal Lists
Fire handles (mouse handling)	13	Simulator handling
Fire overheat/test switch (overhead FIRE panel)	97	Fire Protection
Fire Override switch (and note)	97	Fire Protection
Fire warning inhibition	98	Fire Protection
Fire warnings and associated messages	98	Fire Protection
Fire wheel well (abnormal list)	314	Abnormal Lists
First Officer menu option	24	Simulator handling
Fix database modification	32	Simulator Programming
FIX ETA line (HOLD page)	178	FMC
FIX key (CDU)	144	FMC
Fix line (Fix page)	147	FMC
FIX line (HOLD page)	178	FMC
FIX page (FMC)	147	FMC
FIX2TXT utility	33	Simulator Programming
Flap lever	105	Flight Controls
Flap limiting (placard) speeds	105, 241	Flight Controls
Flap load relief	107	Flight Controls
Flap manœuvring speeds (PFD)	114	Flight Instruments
Flap override/ground proximity switch	227	Warning Systems
Flap placard speeds	105, 241	Limitations
Flap position indicator	106	Flight Controls
Flap position indicator (secondary mode)`	106	Flight Controls
Flap/Acceleration Height line (TAKE-OFF REF page)	159	FMC
FLAP/SPEED line (APPROACH REF page)	161	FMC
Flaps (control surfaces)	103	Flight Controls
Flaps (flight controls)	105	Flight Controls

Subject	Page	Major section
Flaps 20 performance	248-251	Performance
Flaps control (abnormal list)	307	Abnormal Lists
Flaps drive (abnormal list)	307	Abnormal Lists
Flaps primary (abnormal list)	307	Abnormal Lists
FLARE (pitch mode ind)	63	Automatic Flight
Flare and touchdown, manual	267	Procedures
FLCH SPD (pitch mode ind)	63	Automatic Flight
FLCH switch (MCP)	57	Automatic Flight
Flight and cockpit preparation	275-279	Procedures
Flight control shutoff N/A (note)	108	Flight Controls
Flight control surfaces	103	Flight Controls
Flight controls (keyboard)	17	Simulator handling
Flight deck photograph	49	Airplane General
Flight Director command bars (PFD)	115	Flight Instruments
Flight Director switch (MCP)	55	Automatic Flight
Flight Level Change (FLCH) switch (MCP)	57	Automatic Flight
Flight Mode Annunciation	61	Automatic Flight
Flight mode annunciators (PFD)	112	Flight Instruments
Flight Number line (Progress page 1 / 2)	150	FMC
Flight path ind (FPV)	117	Flight Instruments
Flight Path Vector ind (PFD)	117	Flight Instruments
Flight planning	245-247	Performance
Flight profile - pneumatics	213	Pneumatics
Flight with unreliable airspeed/Mach indication	264	Performance
Floating (conditional) waypoints (FMC)	170	FMC
FLT (speedbrake detent)	104	Flight Controls
FLT NO line (OFFPATH DES page)	168	FMC
Fluid level (hydraulic synoptic display)	192	Hydraulics
FMC line select key (Menu page)	149	FMC
FMC locked on IDENT page (airline policy load failure)	154	FMC
FMC messages in CDU scratchpad	145-146	FMC
FMC Routes In Store menu option	23	Simulator handling
FORECAST key (VNAV DES page)	165	FMC
FPV (flt path vector) ind (PFD)	117	Flight Instruments
FPV selector (EFIS control panel)	111	Flight Instruments
FREE MEMory (simulator)	27	Simulator handling
FREEZE folder	22	Simulator handling
FREQuency line (REF NAV DATA page)	162	FMC
Frequency selector (comms)	79	Communications
Frequency transfer system (Comms)	79	Communications
Fuel Ballast (fuel synoptic display)	184	Fuel System
Fuel control switch (overhead fire panel)	219	Power Plant
FUEL DISAGREE message left and right USE prompts	151	FMC
Fuel flow inds (ENG lower EICAS display)	222	Power Plant
Fuel jettison (abnormal list)	309	Abnormal Lists
Fuel jettison (fuel system)	185	Fuel System
Fuel jettison control selector (overhead fuel panel)	183	Fuel System
Fuel jettison nozzle valve switches (overhead fuel panel)	183	Fuel System
Fuel leak engine (abnormal list)	310	Abnormal Lists
FUEL line (PERF INIT page)	157	FMC
Fuel management logic (fuel system)	185	Fuel System
Fuel on ind (CF6 and PW4056 only) (ENG lower EICAS display)	222	Power Plant
Fuel pressure engine (abnormal list)	309	Abnormal Lists
Fuel pumps (fuel system)	185	Fuel System
Fuel quantity low (abnormal list)	310	Abnormal Lists
Fuel Synoptic display switch	184	Fuel System
Fuel tank quantity (fuel synoptic display)	184	Fuel System
Fuel to remain (jettison armed) (Primary EICAS)	184	Fuel System
Fuel To Remain selector (overhead fuel panel)	183	Fuel System
Fuel type / temperature (fuel system)	185	Fuel System
Fuel Xfer main 1 & 4 switch (Misc overhead panel)	183	Fuel System
Full alignment (IRS)	136	Flight Instruments

Subject	Page	Major section
Function keys (CDU)	144	FMC
G/S (pitch mode ind)	63	Automatic Flight
GA line (THRUST LIM page)	158	FMC
Gate database modification	35	Simulator Programming
GATE line (POS INIT page)	155	FMC
Gear disagree (abnormal list)	314	Abnormal Lists
Gear door status display (lower EICAS)	205	Landing Gear
GEAR lever	203	Landing Gear
Gear optional system messages note	205	Landing Gear
Gear override/ground proximity switch	227	Warning Systems
Gear position indications (normal and abnormal, upper EICAS)	203	Landing Gear
Gear synoptic display switch	205	Landing Gear
Generator Drive Disconnect switches (overhead ELEC panel)	85	Electrical
Generator switches (overhead ELEC panel)	85	Electrical
Glareshield panel (mouse handling)	12	Simulator handling
Glideslope deviation ind (PFD)	117	Flight Instruments
Glideslope inhibit switch	227	Warning Systems
Glideslope scale (PFD)	117	Flight Instruments
GMT display	134	Flight Instruments
GMT line (POS INIT page)	155	FMC
GPWS	231-235	Warning Systems
GPWS (keyboard)	17	Simulator handling
Gravity transfer ind (fuel synoptic display)	184	Fuel System
Gross Weight line (APPROACH REF page)	161	FMC
Gross weight line (PERF INIT page)	157	FMC
Ground proximity light	227	Warning Systems
Ground Proximity Warning System (GPWS)	231-235	Warning Systems
Ground proximity/flap override switch	227	Warning Systems
Ground proximity/gear override switch	227	Warning Systems
Ground speed lines (POS REF page)	156	FMC
HDG fail ind (ND)	126	Flight Instruments
HDG HOLD (roll mode ind)	62	Automatic Flight
Hdg Hold switch (MCP)	58	Automatic Flight
Hdg Sel (push) switch (MCP)	58	Automatic Flight
HDG SEL (roll mode ind)	62	Automatic Flight
Heading (selected) bug (PFD)	120	Flight Instruments
Heading Hold switch (MCP)	58	Automatic Flight
Heading ind (PFD)	112	Flight Instruments
Heading Indicator (PFD)	120	Flight Instruments
Heading pointer (current) (PFD)	120	Flight Instruments
Heading reference (mag/tru) (PFD)	120	Flight Instruments
Heading reference switch (and note)	134	Flight Instruments
Heading selector (MCP)	58	Automatic Flight
Heading selector switch (MCP)	58	Automatic Flight
Heading window (MCP)	58	Automatic Flight
Headwind (WIND/SLOPE line on TAKE-OFF REF page)	159	FMC
Hi flow ind (ECS synoptic display)	210	Pneumatics
High flow switch (overhead pneumatics panel)	209	Pneumatics
High latitude alignment (IRS)	136	Flight Instruments
HOLD (autothrottle mode ind)	62	Automatic Flight
HOLD AVAIL line (HOLD page)	178	FMC
HOLD key (CDU)	144	FMC
Hold probability (ATC simulation)	24	Simulator handling
HOLDing patterns (FMC)	176-179	FMC
Horizon line (PFD)	115	Flight Instruments
Hot keys	16,17	Simulator handling
Hydraulic fluid quantity (STATus lower EICAS display)	193	Hydraulics
Hydraulic overheat system (abnormal list)	311	Abnormal Lists
Hydraulic pressure demand (abnormal list)	311	Abnormal Lists
Hydraulic pressure engine (abnormal list)	311	Abnormal Lists
Hydraulic pressure system (abnormal list)	312	Abnormal Lists
Hydraulic reservoir (hydraulic synoptic display)	192	Hydraulics

Subject	Page	Major section
Hydraulic synoptic display switch	192	Hydraulics
Hydraulic system pressure (STATus lower EICAS display)	193	Hydraulics
Hydraulic system schematic	194	Hydraulics
Hydraulic system temperature (STATus lower EICAS display)	193	Hydraulics
IAS/MACH display select switch (MCP)	56	Automatic Flight
IAS/MACH selector (MCP)	56	Automatic Flight
IAS/MACH window (MCP)	56	Automatic Flight
ICAO (entered in STEP SIZE line on PERF INIT page)	157	FMC
IDENTification line (REF NAV DATA page)	162	FMC
IDENTification page (FMC)	154	FMC
IDLE (autothrottle mode ind)	62	Automatic Flight
ILS - MLS line (Nav Radio page)	148	FMC
ILS approach, manual	269	Procedures
ILS freq appr ind (PFD)	117	Flight Instruments
ILS noise-abatement	270	Procedures
Inaugural Flight	325-352	The Inaugural Flight
Inboard ailerons elevators and flaps	103	Flight Controls
Inbound course and direction line (HOLD page)	178	FMC
INDB CRS/DIR line (HOLD page)	178	FMC
Index key (IDENT page)	154	FMC
Inertial Reference System (IRS)	136	Flight Instruments
Inflight start envelope ind (upper EICAS display)	221	Power Plant
INHIBIT lines (REF NAV DATA page)	162	FMC
INHIBITED FOR AUTOLAND (ELEC synoptic view)	86	Communications
INIT REF key (CDU)	144	FMC
INIT REF page display strategy	152-153	FMC
Initialisation and Reference pages (FMC) — schematic	152-153	FMC
Installation	9	Simulator handling
Instructor’s page	22-26	Simulator handling
Instructor’s page (mouse handling)	13	Simulator handling
INTC (Intercept Leg To Waypoint function)	174	FMC
INTC CRS key (LEGS pages)	174	FMC
Intercept Course line and key (LEGS pages)	174	FMC
Intercept Leg To Waypoint function	174	FMC
IRS (Inertial Reference System)	136	Flight Instruments
IRS mode selector	136	Flight Instruments
IRS position display switch (EFIS CP)	123	Flight Instruments
IRS position set (POS INIT page)	155	FMC
IRS vertical speed display	120	Flight Instruments
Isolation valve switches (overhead pneumatics panel)	209	Pneumatics
Isolation valves ind (ECS synoptic display)	210	Pneumatics
Jagged arrows (vectors)	41	Simulator Programming
Jettison control selector (overhead fuel panel)	183	Fuel System
Jettison time to complete (fuel synoptic display)	184	Fuel System
Joystick button assignment	20, 32	Simulator handling
Joystick calibration	19, 37	Simulator handling
Joystick handling	19-21	Simulator handling
Joystick key combinations	32	Simulator Programming
Joystick vs real thrust control	21	Simulator handling
Jump to waypoint (Blue page option)	27	Simulator handling
Key combinations for joystick use	32	Simulator Programming
Key Summary menu option	26	Simulator handling
Keyboard handling	14ff	Simulator handling
Keyboard shortcuts	16,17	Simulator handling
LAND 2 (AFDS status ind)	63	Automatic Flight
LAND 3 (AFDS status ind)	63	Automatic Flight
Landing (typical PFD)	121	Flight Instruments
Landing altitude (abnormal list)	297	Abnormal Lists
Landing altitude ind (upper EICAS display)	211	Pneumatics
Landing altitude selection ind (upper EICAS display)	211	Pneumatics
Landing altitude switch (overhead misc panel)	211	Pneumatics
Landing configuration warnings (EICAS messages)	230	Warning Systems

Subject	Page	Major section
Landing data	263	Performance
Landing gear lever	203	Landing Gear
Landing gear speeds	241	Limitations
Landing reference speed ind (PFD)	114	Flight Instruments
Large font entries (CDU)	143	FMC
LAST POSition line (POS INIT page)	155	FMC
Last waypoint line (Progress page 1 / 2)	150	FMC
LAT/LON line select keys (POS INIT page)	155	FMC
Lateral Navigation (LNAV) switch (MCP)	57	Automatic Flight
Latin and South America	319	Airport ICAO codes
Latitude and longitude valid formats	33	Simulator Programming
Latitude line (REF NAV DATA page)	162	FMC
Leaving aircraft checklist	288	Normal Checklists
Left and right ADF line (Nav Radio page)	148	FMC
Left and right USE prompts (Progress page 2/2)	151	FMC
Left and right VOR course/radial (Nav Radio page)	148	FMC
Left and right VOR line (Nav Radio page)	148	FMC
Leg direction and Distance lines (LEGS page)	169	FMC
LEG DISTance line (HOLD page)	178	FMC
LEG TIME line (HOLD page)	178	FMC
LEGS key (CDU)	144	FMC
LEGS page (FMC)	169	FMC
LEGS pages - creating SID/STAR/APPR procedures	37	Simulator Programming
LENGTH line (REF NAV DATA page)	162	FMC
Light switches	47	Airplane General
Line select keys (CDU)	143	FMC
Line titles (CDU)	143	FMC
LNAV (roll mode ind)	62	Automatic Flight
LNAV switch (MCP)	57	Automatic Flight
Load acceleration limitations	241	Limitations
Load situation file (menu option)	22	Simulator handling
Load Video menu option	25	Simulator handling
LOC (roll mode ind)	62	Automatic Flight
LOC failure ind (ND)	117,126	Flight Instruments
LOC switch (MCP)	60	Automatic Flight
Localizer Back Course note	60	Automatic Flight
Localizer deviation ind (PFD)	117	Flight Instruments
Localizer scale (PFD)	117	Flight Instruments
Localizer switch (MCP)	60	Automatic Flight
Long Range Cruise key (VNAV CRZ page)	164	FMC
LONGITUDE line (REF NAV DATA page)	162	FMC
Low visibility operation	242	Limitations
Lower recirculation fan switch (overhead misc panel)	211	Pneumatics
Lower rudder	103	Flight Controls
LRC cruise Mach schedule	258	Performance
LRC key (VNAV CRZ page)	164	FMC
LSK (line select key — CDU)	143	FMC
Mach .86 cruise performance	254-257	Performance
Mach ind (PFD)	113	Flight Instruments
MAG landing reference	134	Flight Instruments
MAG VAR line (REF NAV DATA page)	162	FMC
Main tank pump switches (overhead fuel panel)	183	Fuel System
Main tank pumps (fuel synoptic display)	184	Fuel System
Maintenance panel switches (fuel system) note	187	Fuel System
Manual Crew ILS entry (NAV RADIO page)	148	FMC
Manual descent	267	Procedures
Manual flare and touchdown	267	Procedures
Manual ILS approach	269	Procedures
Manual non-precision approach	271	Procedures
Manual take-off	268	Procedures
Map Centre Step key (LEGS page)	169	FMC
MAP CTR ND appearance	124	Flight Instruments

Subject	Page	Major section
MAP fail ind (ND)	126	Flight Instruments
MAP ND appearance	124	Flight Instruments
MAP ND mode (EFIS CP)	122	Flight Instruments
Map range disagree ind (ND)	126	Flight Instruments
MAP switch (EFIS CP)	123	Flight Instruments
Marker beacon annunciator (PFD)	117	Flight Instruments
Master caution light	227	Warning Systems
Master warning light	227	Warning Systems
Master warning/caution reset switch	227	Warning Systems
MAX and OPT line (VNAV CRZ page)	164	FMC
MAX ANGLE line (VNAV CLB page)	163	FMC
Maximum altitudes	241	Limitations
Maximum manœuvring speed ind (PFD)	113	Flight Instruments
Maximum N1 inds (upper EICAS display)	220	Power Plant
Maximum speed ind (PFD)	113	Flight Instruments
Maximum start limit inds EGT (upper EICAS display)	221	Power Plant
Maximum tyre speed	241	Limitations
MCP	55	Automatic Flight
MCP alt selected bug (PFD)	118	Flight Instruments
MCP alt selected ind (PFD)	118	Flight Instruments
MDA ind (PFD)	119	Flight Instruments
MDA/DH control (EFIS control panel)	111	Flight Instruments
MDA/DH selector (EFIS control panel)	111	Flight Instruments
Memo messages (EICAS)	228	Warning Systems
MENU key (CDU)	144	FMC
MENU page (FMC)	149	FMC
Message light (CDU)	144	FMC
METAR (ACARS)	81	Communications
Metric alt display (current) (PFD)	119	Flight Instruments
Metric alt selected (PFD)	119	Flight Instruments
Middle East	321	Airport ICAO codes
Minimum Descent Altitude disp (PFD)	119	Flight Instruments
Minimum manœuvring speed ind (PFD)	113	Flight Instruments
Minimum speed ind (PFD)	113	Flight Instruments
Mixed IRS (RAD UPDATE key, POS REF page)	156	FMC
MM beacon ind (PFD)	117	
Mode 1, GPWS	231	Warning Systems
Mode 2, GPWS	231,232	Warning Systems
Mode 3, GPWS	231,233	Warning Systems
Mode 4, GPWS	231,234	Warning Systems
Mode 5, GPWS	231,235	Warning Systems
Mode 6 (config-specific), GPWS	231,235	Warning Systems
Mode 7, GPWS	231,235	Warning Systems
Mode changes (note)	61	Automatic Flight
Mode Control Panel (MCP)	55-60	Automatic Flight
Mode faults (note)	61	Automatic Flight
Model line (IDENT page)	154	FMC
Modifying ATC Transition level	35	Simulator Programming
Modifying Gate database	35	Simulator Programming
Modifying the Airport Database	34	Simulator Programming
Modifying the Fix database	31	Simulator Programming
Mouse handling	11	Simulator handling
Mouse on (Preferences menu item)	26	Simulator handling
Move keys (Edit Fix)	34	Simulator Programming
MSG light (CDU)	144	FMC
Mtrs altitude selector (EFIS control panel)	111	Flight Instruments
Multiple engine flameout or stall (abnormal list)	303	Abnormal Lists
N1 (VNAV CRZ page TARGET THRUST line)	164	FMC
N1 RPM inds (upper EICAS display)	220	Power Plant
N2 RPM inds (ENG lower EICAS display)	222	Power Plant
N3 RPM inds (RB211 only) (ENG lower EICAS display)	222	Power Plant
Nacelle anti-ice pushbuttons (overhead misc panel)	199	Ice Protection

Subject	Page	Major section
Nacelle anti-ice status inds (upper EICAS display)	220	Power Plant
Nacelle anti-ice switches (overhead misc panel)	199	Ice Protection
Nacelle thermal anti-ice ind (ECS synoptic display)	210	Pneumatics
NAV (IRS mode)	136	Flight Instruments
Nav data line (IDENT page)	154	FMC
Nav database keys (IDENT page)	154	FMC
Nav lights control (overhead MISC panel)	47	Airplane General
NAV RAD key (CDU)	144	FMC
NAV RADIO page (FMC)	148	FMC
Nav stations line (POS REF page)	156	FMC
Navaid display switch STA (EFIS CP)	123	Flight Instruments
NAVAID INHIBIT lines (REF NAV DATA page)	162	FMC
Navigation Display (ND)	124-133	Flight Instruments
Navigation Radio page (FMC)	148	FMC
ND (Navigation Display)	124-133	Flight Instruments
ND controls (EFIS CP)	122	Flight Instruments
ND controls on EFIS CP	111	Flight Instruments
ND DISPLAY key (OFFPATH DES page)	167	FMC
ND failure flags	126	Flight Instruments
ND mode selector (EFIS CP)	122	Flight Instruments
ND symbol overview	128-133	Flight Instruments
ND TCAS messages	127	Flight Instruments
ND typical indications	124-125	Flight Instruments
New Position/Time menu option	22	Simulator handling
NEXT PAGE key (CDU)	144	FMC
Next waypoint jump (Blue page option)	27	Simulator handling
NO AUTOLAND (AFDS status ind)	63	Automatic Flight
NO BEARING (ND TCAS msg)	127	Flight Instruments
No smoking selector	48	Airplane General
Noise-abatement ILS	270	Procedures
Non-precision approach, manual	271	Procedures
North America	319	Airport ICAO codes
Nose wheel steering (mouse handling)	13	Simulator handling
Nose wheel steering tiller	204	Landing Gear
OAT column (WINDS pages)	173	FMC
OAT line (THRUST LIM page)	158	FMC
OFFPATH DEScent page (FMC)	167	FMC
OFFSCALE (ND TCAS msg)	127	Flight Instruments
Offset light (CDU)	144	FMC
OFFSET line (OFFPATH DES page)	168	FMC
OFST (offset) light (CDU)	144	FMC
Oil pressure inds (ENG lower EICAS display)	222	Power Plant
Oil qty ind (APU)	75	Auxiliary Power
Oil quantity ind (ENG lower EICAS display)	222	Power Plant
Oil temperature ind (ENG lower EICAS display)	222	Power Plant
OM beacon ind (PFD)	117	Flight Instruments
OP PROGRAM line (IDENT page)	154	FMC
OPT and MAX line (VNAV CRZ page)	164	FMC
ORIGIN line (OFFPATH DES page)	168	FMC
Other DEP/ARR line (DEP/ARR page)	175	FMC
Other traffic display	236	Warning Systems
Outboard ailerons elevators and flaps	103	Flight Controls
Outflow valve positions (ECS synoptic display) (always AUTO in sim)	210	Pneumatics
Outside Air Temperature column (WINDS pages)	173	FMC
Overhead fuel panel	183	Fuel System
Overhead panel (mouse handling)	12	Simulator handling
Overhead panel (yellow box)	16	Simulator handling
Overhead panel photograph	49	Airplane General
Overheat cautions	98	Fire Protection
Overheat engine nacelle	306	Abnormal Lists
OVERLAY ind (simulator)	27	Simulator handling
Override pump switches (overhead fuel panel)	183	Fuel System

Subject	Page	Major section
Override/jettison pumps (fuel synoptic display)	184	Fuel System
Overspeed warning	230	Warning Systems
Overwrite on disk (Edit Fix)	33	Simulator Programming
Oxygen limits	241	Limitations
Oxygen pressure (STAT synoptic view)	48	Airplane General
Pack (abnormal list)	297	Abnormal Lists
Pack control selectors (overhead pneumatics panel)	209	Pneumatics
Pack controls ind (ECS synoptic display)	210	Pneumatics
Pack reset switch (overhead pneumatics panel)	209	Pneumatics
Page number (EICAS messages)	228	Warning Systems
Page numbers (CDU)	143	FMC
Page numbers on FMC	32	Simulator Programming
Page title (CDU)	143	FMC
Parallel entry note	179	FMC
Paravisual Display	135	Flight Instruments
PARK (Autotuning ILS entry) (NAV RADIO page)	148	FMC
Parking brake lever	204	Landing Gear
Parking checklist	288	Normal Checklists
Passenger oxygen switch (note)	48	Airplane General
Passenger sign controls	48	Airplane General
Pattern modifications note	179	FMC
Pattern size note	179	FMC
PBD entries (FMC) (no decimals allowed in sim)	147	FMC
PERFormance INITialisation page (FMC)	157	FMC
PFD controls (EFIS CP)	122	Flight Instruments
PFD controls on EFIS CP	111	Flight Instruments
PFD failure flags	112	Flight Instruments
PFD indications	112	Flight Instruments
PFD indications (typical)	121	Flight Instruments
Pitch down advisory (TCAS) (PFD)	116	Flight Instruments
Pitch limit ind (PLI) (PFD)	115	Flight Instruments
Pitch mode (armed/engaged) ind (PFD)	61	Automatic Flight
Pitch mode ind (PFD)	61	Automatic Flight
Pitch modes	63	Automatic Flight
Pitch scale (PFD)	115	Flight Instruments
Pitch up advisory (TCAS) (PFD)	116	Flight Instruments
Placard speeds	105	Flight Controls
Place-Bearing-Distance sim entries (no decimals allowed)	147, 169	FMC
PLAN key (CDU)	144	FMC
PLN ND appearance	124	Flight Instruments
PLN ND mode (EFIS CP)	122	Flight Instruments
PLOTTER FREE TIME (simulator)	27	Simulator handling
Pneumatics typical flight profile	213	Pneumatics
POS INIT key (IDENT page)	154	FMC
POS ND appearance	124	Flight Instruments
POS switch (EFIS CP)	123	Flight Instruments
POSition INITialisation page (FMC)	155	FMC
Position lines (POS REF page)	156	FMC
POSition REFerence page (FMC)	156	FMC
POSition SHIFT line (TAKE-OFF REF page)	160	FMC
Power plant (GE CF5-80C2BF1F)	241	Limitations
Power setting (keyboard)	16	Simulator handling
PPOS key (create holding fix at present position)	177	FMC
Predicted ETA/ALT line (Fix page)	147	FMC
Preferences menu option	26	Simulator handling
Preflight Items menu option	23	Simulator handling
PRE-FLT indication (TAKE-OFF REF page)	160	FMC
Preselect lines (Nav Radio page)	148	FMC
Preselected baro alt setting (PFD)	118	Flight Instruments
Preset baro alt setting (PFD)	118	Flight Instruments
PRESS lights (overhead hydraulic panel)	191	Hydraulics
PREV PAGE key (CDU)	144	FMC

Subject	Page	Major section
Primary engine indications	220-221	Power Plant
Primary mode flap position indication	106	Flight Controls
Procedure database (note)	175	FMC
PROG key (CDU)	144	FMC
PROGRESS page 1 / 2 (FMC)	150	FMC
PROGRESS page 2 / 2 (FMC)	151	FMC
Propagated data (waypoint WINDS page) — rules	173	FMC
Proximate traffic display	236	Warning Systems
Pull up warning	231	Warning Systems
Pull up warning ind (PFD)	115	Flight Instruments
PVD	135	Flight Instruments
QUAD/RADIAL line (HOLD page)	178	FMC
Quit menu option	26	Simulator handling
RA	236	Warning Systems
Radio altitude ind (PFD)	119	Flight Instruments
Radio Tuning panel	79	Communications
Radio update key (POS REF page)	156	FMC
Random Malfunctions menu option	23	Simulator handling
Range disagree ind (ND)	126	Flight Instruments
Rebuild Nav sector (Blue page option)	27	Simulator handling
Recall ind (EICAS messages)	228	Warning Systems
Recall switch (EICAS messages)	229	Warning Systems
Red line EGT max inds (upper EICAS display)	221	Power Plant
Red line N2 RMP limit inds (ENG lower EICAS display)	222	Power Plant
Red line RPM limit inds (upper EICAS display)	220	Power Plant
REF AIRPORT line (POS INIT page)	155	FMC
Reference N1 inds (upper EICAS display)	220	Power Plant
REFerence NAVigation DATA page (FMC)	162	FMC
Refuelling (fuel system)	185	Fuel System
Remove Fix (modify Fix database)	33	Simulator Programming
Remove Fix from disk LSK	33	Simulator Programming
Renaming waypoints	38	Simulator Programming
Requirements (creating SID/STAR/APPRs)	38	Simulator Programming
Reserve transfer (fuel synoptic display)	184	Fuel System
Reserves line (PERF INIT page)	157	FMC
Reservoir pressure (hydraulic synoptic display)	192	Hydraulics
Reset loast loaded situation (menu option)	22	Simulator handling
Resolution advisory and display	236	Warning Systems
RET (ALTN FLAPS selector)	105	Flight Controls
RF = REF (landing ref speed ind)	114	Flight Instruments
Roll mode (armed/engaged) ind (PFD)	61	Automatic Flight
Roll mode ind (PFD)	61	Automatic Flight
Roll modes	62	Automatic Flight
ROLLOUT (roll mode ind)	62	Automatic Flight
ROU files	36	Simulator Programming
Round analogue RA display	119	Flight Instruments
Route 2 key (OFFPATH DES page)	168	FMC
Route Copy key (LEGS pages)	174	FMC
Route Data page (FMC)	172	FMC
Route discontinuity (FMC)	171	FMC
ROUTE page (FMC)	168	FMC
RPM ind (APU)	75	Auxiliary Power
RSTR inop disp (ND)	126	Flight Instruments
RTE 2 key (OFFPATH DES page)	168	FMC
RTE 2 LEGS key (LEGS page)	169	FMC
RTE COPY key (LEGS pages)	174	FMC
RTE DATA page (FMC)	172	FMC
RTE key (CDU)	144	FMC
RTE page (FMC)	168	FMC
Rudder (control surfaces)	103	Flight Controls
Rudder position (control surfaces) (lower EICAS display)	103	Flight Controls
Rudder trim centring switch	104	Flight Controls

Subject	Page	Major section
Rudder trim control switch	104	Flight Controls
Run (engine) switches (overhead fire panel)	219	Power Plant
Runway condition line (TAKE-OFF REF page)	159	FMC
Runway keys (Edit Fix)	34	Simulator Programming
Runway length line (APPROACH REF page)	161	FMC
RUNWAY line (OFFPATH DES page)	168	FMC
Runway Line Select Keys (DEP/ARR page)	175	FMC
Runway page (Edit Fix)	34	Simulator Programming
Runway selection (ATC simulation)	24	Simulator handling
Runway slope limits	241	Limitations
RUNWAYS LSKs (DEP/ARR page)	175	FMC
S suffix (STEP TO ALTITUDE line)	164	FMC
Sample procedures (DEP/ARR) provided with database	175	FMC
SAT line (Progress page 2/2)	151	FMC
Save (airport database modifications)	34	Simulator Programming
Save As menu option (saves Situation)	22	Simulator handling
SAVE AS simulator option (saves Route)	27, 36	Simulator handling
Save current situation every 7 minutes (Preferences menu item)	26	Simulator handling
Saving Company Routes	36	Simulator Programming
Saving SID/STAR/APPROACH procs	40	Simulator Programming
Scavange pump transfer ind (fuel synoptic display)	184	Fuel System
Scratchpad line (CDU)	143	FMC
Seatbelts selector	48	Airplane General
Second auxiliary pump (note)	191	Hydraulics
Secondary engine exceedance cue (upper EICAS display)	221	Power Plant
Secondary engine indications	222	Power Plant
Secondary mode flap position indication	106	Flight Controls
SEL SPD line (VNAV CRZ page)	164	FMC
SELECT DESIRED WAYPOINT (FMC)	171	FMC
Selected heading bug (PFD)	120	Flight Instruments
Selected MCP altitude (PFD)	118	Flight Instruments
Selected MCP altitude bug (PFD)	118	Flight Instruments
Selected metric alt (PFD)	119	Flight Instruments
Selected vertical speed bug (PFD)	120	Flight Instruments
Separate autostart switches (config option EEC+IRS overhead)	222	Power Plant
SET IRS position (POS INIT page)	155	FMC
SET NOW key (vectors)	43	Simulator Programming
Shutdown APU	75	Auxiliary Power
Shutoff valve (hydraulic synoptic display)	192	Hydraulics
SID line select keys (DEP/ARR page)	175	FMC
SID procedures, creating	37-39	Simulator Programming
SID procedures, saving	40	Simulator Programming
SID/STAR procedures (creating)	37	Simulator Programming
Simplified alternative flight planning	247	Performance
Simplified flight planning .86 Mach cruise	245,246	Performance
Simu key (Edit Fix)	33	Simulator Programming
SIMULATOR INTERNAL blue page	27	Simulator handling
SIMUlator key (blue font) (Menu page)	149	FMC
Simulator-specific options	27	Simulator handling
Sink rate	231	Warning Systems
Siren aural alert (EICAS messages)	229	Warning Systems
Situation at program start (Preferences menu item)	26	Simulator handling
Slip/Skid ind (attitude ind)	115	Flight Instruments
Small font entries (CDU)	143	FMC
Smoke air conditioning (abnormal list)	298	Abnormal Lists
Sound Blaster (Preferences menu item)	26	Simulator handling
Sound file format (videos)	44	Simulator Programming
Sound memory (Blue page option)	27	Simulator handling
Source Selectors (note)	93	Electrical
SP key (CDU)	144	FMC
SPD (autothrottle mode ind)	62	Automatic Flight
SPD (speed) line (VNAV CLB page)	163	FMC

Subject	Page	Major section
SPD line (OFFPATH DES page)	167	FMC
SPD line (VNAV DES page)	165	FMC
SPD RESTR line (OFFPATH DES page)	167	FMC
SPD RESTR line (VNAV CLB page)	163	FMC
SPD RESTR line (VNAV DES page)	165	FMC
SPD TRANS line (OFFPATH DES page)	167	FMC
SPD TRANS line (VNAV CLB page)	163	FMC
SPD TRANS line (VNAV DES page)	165	FMC
SPD/ALT line (OFFPATH DES page)	167	FMC
SPD/TGT line (HOLD page)	178	FMC
Speed line (OFFPATH DES page)	167	FMC
Speed line (Progress page 1 / 2)	150	FMC
Speed line (VNAV CRZ page)	164	FMC
Speed line (VNAV DES page)	165	FMC
Speed switch (MCP)	56	Automatic Flight
Speed Transition altitude of departure airport	163	FMC
Speed Transition altitude of destination airport (OFFPATH DES page)	167	FMC
Speed Transition altitude of destination airport (VNAV DES page)	165	FMC
Speed warnings	230	Warning Systems
Speed/Altitude lines (LEGS page)	169	FMC
Speed/Target altitude line (HOLD page)	178	FMC
Speedbrake automatic (abnormal list)	308	Abnormal Lists
Speedbrake lever	104	Flight Controls
Split System Breaker ind (lower EICAS display)	86	Electrical
Spoiler position (control surfaces) (lower EICAS display)	103	Flight Controls
SSB (split system breaker) (lower EICAS display)	86	Electrical
STA ND appearance	124	Flight Instruments
STA switch (EFIS CP)	123	Flight Instruments
Stab tank transfer (fuel synoptic display)	184	Fuel System
Stab trim cutout N/A (note)	108	Flight Controls
Stab trim indicator	104	Flight Controls
Stab trim line (TAKE-OFF REF page)	160	FMC
Stab trim switches	104	Flight Controls
Stabilizer (control surfaces)	103	Flight Controls
Stabilizer tank pump switches (overhead fuel panel)	183	Fuel System
Stabilizer trim indicator	104	Flight Controls
Stabilizer trim switches	104	Flight Controls
Stall warning	230	Warning Systems
Standard Instrument Departure LSKs (DEP/ARR page)	175	FMC
Standard Terminal Arrival Route keys (DEP/ARR page)	175	FMC
Standby frequency ind (comms)	79	Communications
Standby ignition selector (overhead engine start+fuel panel)	219	Power Plant
Standby instruments	137	Flight Instruments
Standby Power selector (overhead ELEC panel)	85	Electrical
STAR procedures, creating	37-39	Simulator Programming
STAR procedures, saving	40	Simulator Programming
STARS keys (DEP/ARR page)	175	FMC
Starting PS1 under DOS	10	Simulator handling
Starting PS1 under Windows 95/98	10	Simulator handling
Status cue (EICAS messages)	228	Warning Systems
STATus Display switch (control surface ind)	103	Flight Controls
STATus Display switch (EICAS messages)	229	Warning Systems
STATus Display switch (Hydraulics)	193	Hydraulics
STATus Display switch (lower EICAS display)	86	Electrical
Status messages (EICAS messages)	228	Warning Systems
STD display (PFD)	118	Flight Instruments
Steering tiller	204	Landing Gear
STEP key (LEGS page)	169	FMC
Step size line (PERF INIT page)	157	FMC
STEP SIZE line (VNAV CRZ page)	164	FMC
STEP TO altitude line (VNAV CRZ page)	164	FMC
Stick checklist	289	Normal Checklists

Subject	Page	Major section
STOP NOW key (vectors	43	Simulator Programming
Strobe lights control (overhead MISC panel)	47	Airplane General
Switch handling (yellow box)	14,15	Simulator handling
Switches on maintenance panel (fuel system) note	187	Fuel System
Symbols, appearing on ND	128-133	Flight Instruments
SYS FAULT lights (overhead hydraulic panel)	191	Hydraulics
System requirements	9	Simulator handling
TA	236	Warning Systems
TA ONLY (ND TCAS msg)	127	Flight Instruments
TAF (ACARS)	81	Communications
TAI/ON ALT line (DESC FCASTS page)	166	FMC
Tailwind (WIND/SLOPE line on TAKE-OFF REF page)	159	FMC
Take-off	267	Procedures
Take-off (typical PFD)	121	Flight Instruments
Take-off (typical)	66	Automatic Flight
Take-off checklist	287	Normal Checklists
Take-off configuration warnings (EICAS messages)	230	Warning Systems
Take-off phase inhibits (fire warnings)	98	Fire Protection
Take-off Profile menu option	25	Simulator handling
TAKE-OFF REFerence page (FMC)	159-160	FMC
Take-off reference speeds (PFD)	114	Flight Instruments
Take-off, manual	268	Procedures
Take-off/Go-around switch	64	Automatic Flight
Tank quantity (fuel synoptic display)	184	Fuel System
Tape position (videos)	44	Simulator Programming
Target altitude/speed line (HOLD page)	178	FMC
Target thrust line (VNAV CRZ page)	164	FMC
TAT indicator (upper EICAS display)	220	Power Plant
Taxy	267	Procedures
Taxy check checklist	287	Normal Checklists
Taxying out and take-off	281-282	Procedures
TCAS	236	Warning Systems
TCAS FAIL (ND TCAS msg)	127	Flight Instruments
TCAS messages on ND	127	Flight Instruments
TCAS mode display	127	Flight Instruments
TCAS mode selector	236	Warning Systems
TCAS OFF (ND TCAS msg)	127	Flight Instruments
TCAS RA command (on VSI)	120	Flight Instruments
TCAS RA pitch commands (PFD)	116	Flight Instruments
TCAS TEST (ND TCAS msg)	127	Flight Instruments
TCAS Training menu option	22	Simulator handling
Teardrop entry note	179	FMC
Telex (ACARS)	80	Communications
Ten thousand (alt) digit display (PFD)	118	Flight Instruments
TFC (ND TCAS msg)	127	Flight Instruments
TFC (traffic) switch (EFIS CP)	122	Flight Instruments
TFC switch	236	Warning Systems
THR (autothrottle mode ind)	62	Automatic Flight
THR REF (autothrottle mode ind)	62	Automatic Flight
Thrust control (mouse handling)	13	Simulator handling
THRUST LIMit page (FMC)	158	FMC
Thrust mode and limit line (THRUST LIM page)	158	FMC
Thrust modes (THRUST LIM page)	64,158	FMC
Thrust reduction line (TAKE-OFF REF page)	159	FMC
Thrust reference mode ind (upper EICAS display)	220	Power Plant
Thrust switch (MCP)	56	Automatic Flight
Time remaining for track plots (Blue page option)	27	Simulator handling
Time to complete jettison (fuel synoptic display)	184	Fuel System
Tire pressure display (lower EICAS)	205	Landing Gear
Title line (VNAV CLB page)	163	FMC
Title line (VNAV CRZ page)	164	FMC
Title line (VNAV DES page)	165	FMC

Subject	Page	Major section
TO 3 thrust mode (Not available in sim - note)	158	FMC
To and Next waypoint line (Progress page 1 / 2)	150	FMC
TO B thrust mode (Not available in sim - note)	158	FMC
To line (Progress page 1 / 2)	150	FMC
TO line (THRUST LIM page)	158	FMC
TO lines (OFFPATH DES page)	168	FMC
TO/GA (pitch mode ind)	63	Automatic Flight
TO/GA (roll mode ind)	62	Automatic Flight
TO/GA switch	64	Automatic Flight
TO1 line (THRUST LIM page)	158	FMC
TO2 line (THRUST LIM page)	158	FMC
Totalizer fuel quantity line (Progress page 2/2)	151	FMC
Touch-and-go training pattern	274	Procedures
Track ind (PFD)	120	Flight Instruments
Track Plotter menu option	25	Simulator handling
Traffic switch	236	Warning Systems
TRAFFIC (ND TCAS msg)	127	Flight Instruments
Traffic advisory and display	236	Warning Systems
Traffic Collision And avoidance System (TCAS)	236	Warning Systems
Traffic display, other	236	Warning Systems
Traffic switch (EFIS CP)	122	Flight Instruments
Training pattern	274	Procedures
TRANS LVL line (DESC FCASTS page)	166	FMC
Transfer/jettison pumps (fuel synoptic display)	184	Fuel System
TRANSition ALTitude line (VNAV CLB page)	163	FMC
Transition Level line (DESC FCASTS page)	166	FMC
TRANSMIT NOW key (vectors)	43	Simulator Programming
Trend (airspeed) ind (PFD)	114	Flight Instruments
Trim (stab) line (TAKE-OFF REF page)	160	FMC
Trim air switch (overhead misc panel)	211	Pneumatics
TRU landing reference	134	Flight Instruments
True airspeed line (Progress page 2/2)	151	FMC
Turbulent air penetration	251	Limitations
Turnoff lights (note)	47	Airplane General
Two engines inoperative (abnormal list)	306	Abnormal Lists
Two engines inoperative landing	272	Procedures
Typical flight profile — pneumatics	213	Pneumatics
Typical PFD indications	121	Flight Instruments
Tyre pressure display (lower EICAS)	205	Landing Gear
Tyre pressure limits	241	Limitations
Undercarriage lever	203	Landing Gear
Unreliable airspeed/Mach	264	Performance
Unsafe terrain clearance while not in landing configuration (GPWS)	234	Warning Systems
UP (speedbrake detent)	104	Flight Controls
Uplink (ACARS)	81	Communications
Upper recirculation fan switch (overhead misc panel)	211	Pneumatics
Upper rudder	103	Flight Controls
Upslope (WIND/SLOPE line on TAKE-OFF REF page)	159	FMC
USE prompts (left and right) (Progress page 2/2)	151	FMC
Utility Power switches (overhead ELEC panel)	85	Electrical
V/S (pitch mode ind)	63	Automatic Flight
V1 line (TAKE-OFF REF page)	160	FMC
V2 line (TAKE-OFF REF page)	160	FMC
V2 marker (note)	114	Flight Instruments
V-bars (FD) (PFD)	115	Flight Instruments
VDM files	44	Simulator Programming
VDR files	44	Simulator Programming
VDS files	44	Simulator Programming
VEC files	41	Simulator Programming
Vectors scenarios	41-43	Simulator Programming
VECTORS waypoint	27, 41	Simulator Programming
Vertical Navigation (VNAV) switch (MCP)	57	Automatic Flight

Subject	Page	Major section
Vertical speed (selected) bug (PFD)	120	Flight Instruments
Vertical Speed display (PFD)	120	Flight Instruments
Vertical Speed ind (PFD)	112	Flight Instruments
Vertical Speed Indicator (PFD)	120	Flight Instruments
Vertical speed pointer (PFD)	120	Flight Instruments
Vertical Speed selector (MCP)	59	Automatic Flight
Vertical Speed switch (MCP)	59	Automatic Flight
Vertical Speed window (MCP)	59	Automatic Flight
Vertical track error line (Progress page 2/2)	151	FMC
VIA files	36	Simulator Programming
VIA lines (OFFPATH DES page)	168	FMC
Vibration inds (ENG lower EICAS display)	222	Power Plant
Video recording (advanced)	44	Simulator Programming
VIDEOS folder	44	Simulator Programming
View Log Time menu option	25	Simulator handling
VNAV (pitch mode ind)	63	Automatic Flight
VNAV ALT (pitch mode ind)	63	Automatic Flight
VNAV CLB (climb) page (FMC)	163	FMC
VNAV CRZ (cruise) page (FMC)	164	FMC
VNAV DEScent page (FMC)	165	FMC
VNAV key (CDU)	144	FMC
VNAV PTH (pitch mode ind)	63	Automatic Flight
VNAV SPD (pitch mode ind)	63	Automatic Flight
VNAV switch (MCP)	57	Automatic Flight
Volcanic ash (abnormal list)	304	Abnormal Lists
VOR course/radial (left and right) (Nav Radio page)	148	FMC
VOR CTR ND appearance	124	Flight Instruments
VOR INHIBIT key (REF NAV DATA page)	162	FMC
VOR L or R fail ind (ND)	126	Flight Instruments
VOR line (left and right) (Nav Radio page)	148	FMC
VOR ND appearance	124	Flight Instruments
VOR ND mode (EFIS CP)	122	Flight Instruments
VOR ONLY INHIBIT lines (REF NAV DATA page)	162	FMC
VOR tracking modes (note)	60	Automatic Flight
VOR/ADF switch (EFIS CP)	122	Flight Instruments
VR line (TAKE-OFF REF page)	160	FMC
VREF lines (APPROACH REF page)	161	FMC
VTK fail ind (ND)	126	Flight Instruments
Wailer aural alert (EICAS messages)	229	Warning Systems
Wapoint constraint line (VNAV CLB page)	163	FMC
Warning light (master)	227	Warning Systems
Warning messages (EICAS)	228	Warning Systems
Waypoint (Select Desired — FMC)	171	FMC
Waypoint constraint line (VNAV DES page)	165	FMC
Waypoint Fuel (RTE DATA pages)	172	FMC
Waypoint identifier lines (LEGS page)	169	FMC
Waypoint jump function (Blue page option)	27	Simulator handling
Waypoint switch (EFIS CP)	123	Flight Instruments
Waypoint WINDS pages (FMC)	173	FMC
Waypoint, Direct To function	174	FMC
Waypoint, Intercept Leg To function	174	FMC
Waypoints (creating Approaches)	38	Simulator Programming
Waypoints (creating SIDs/STARs)	37	Simulator Programming
Weather (ACARS)	81	Communications
Weather menu options	23	Simulator handling
Weather switch (EFIS CP)	123	Flight Instruments
Weight limitations	241	Limitations
Wet runway line (TAKE-OFF REF page)	159	FMC
WGS84 standard	34	Simulator Programming
Wheel numbering diagram	204	Landing Gear
WIND DIR/SPD lines (DESC FCASTS page)	166	FMC
Wind direction/speed lines (WINDS pages)	173	FMC

Subject	Page	Major section
Wind limits	241	Limitations
Wind limits, side and lower cargo door	241	Limitations
Wind line (Progress page 2/2)	151	FMC
WIND Line Select Keys (RTE DATA pages)	172	FMC
Wind/Slope line (TAKE-OFF REF page)	159	FMC
Wind-Altitude trade	259	Performance
Windows 95/98 installation	9	Simulator handling
WINDS (Waypoint — FMC)	173	FMC
Windshear detection	235	Warning Systems
Windshear warning ind (PFD)	115	Flight Instruments
Wing anti-ice status inds (upper EICAS display)	220	Power Plant
Wing anti-ice switch (overhead misc panel)	199	Ice Protection
Wing anti-ice valve (abnormal list)	299	Abnormal Lists
Wing landing lights	47	Airplane General
Wing TAI (thermal anti-ice) ind (ECS synoptic display)	210	Pneumatics
WPT ND appearance	124	Flight Instruments
WPT switch (EFIS CP)	123	Flight Instruments
WXR fail disp (ND)	126	Flight Instruments
WXR ND appearance	124	Flight Instruments
WXR range disagree ind (ND)	126	Flight Instruments
WXR switch (EFIS CP)	123	Flight Instruments
X arrival procedures in the FMC	40, 175	Simulator Programming
Yaw damper switches N/A (note)	108	Flight Controls
Yellow box movement	14	Simulator handling
ZFW line (PERF INIT page)	157	FMC
Zone temperatures ind (ECS synoptic display) (always °C in sim)	210	Pneumatics

(N.B. For EICAS, FMC, and CDU scratchpad messages with cross-reference to Abnormal Lists, see separate list. The Navigation Display TCAS messages are included above, however).

Appendix 12: Messages and abnormal procedures

As listed in the Precision Simulator 744 version 1.3 manual

Includes EICAS, FMC, and CDU scratchpad messages, abnormal checklists references, and comments by Rets

Listing compiled by Brian Cowell — E&OE
Rets' observations by Rets ☺

The page references are taken directly from the PS 1.3 manual. The Type column uses that manual's abbreviations:— W = warning (red); C = caution (amber); A = advisory (amber); M = memo (white); and S = status (white). Also peculiar to this list I have added P = airline-specific; and SCR indicating a message in the CDU scratchpad (please note that no distinction is made between those messages which will cause the "FMC MESSAGE" advisory to appear and those which will not).

See the PS 1.3 manual page 228 for definitions of 'Warning', 'Caution', 'Advisory', and 'Memo' messages. For Navigation Display TCAS messages see the Contents list below, and page 127 of Hardy's manual. The "Comment" column on the right of this list contains (surprise) the comments (as found in the PS 1.3 manual).

N.B. Messages which are prefixed by a "greater than" (>) sign are here shown with it *suffixed*, so as not to unduly confuse the sort order. Some messages may appear to be duplicated — refer also to the 'Type' column in these cases to distinguish between them.

The "Ind" column contains associated indications, if any, *and also the page number in the PS 1.3 manual of the associated Abnormal List* in the form AB xxx (where xxx is the page number: note that some pages in the 1.3 manual contain several lists — select the appropriate one according to the specific message). This version additionally adds the page reference (in *this* document) to any comments Rets has — I am most grateful to him for allowing me to reproduce his wisdom here.

Finally, be aware that the following abnormal lists have no particular associated message listed:—

Emergency descent	p. 294 (see also Rets' comments on p. 149, here)
Smoke air conditioning	p. 298 (see also Rets' comments on p. 149, here)
Multiple engine flameout or stall	p. 303
Volcanic ash	p. 304 (see also Rets' comments on p. 149, here)
Engine failure/shutdown	p. 304
Engine in-flight start	p. 305
Two engines inoperative	p. 306 (see also Rets' comments on p. 150, here)
Fuel jettison	p. 309
Ditching	p. 315

Message	Page	Type	Ind	Comment
A/P SINGLE SYS	71	S		No autopilot redundancy. Autopilot revisionary configuration.
ACARS MESSAGE	82	M		An uplinked ACARS message has been received from a ground station

Message	Page	Type	Ind	Comment
ACARS MU	82	S		ACARS Management Unit failed or inactive
ACARS UPLINK	82	SCR		An ACARS uplink from a ground station has been received. Select the “ACARS REC MSGS” page on the CDU.
ADC ( )	138	S		ADC (left, centre, or right) inoperative
ADC ( ) >	138	A		ADC (left, centre, or right) inoperative
ADF ( )	138	S		ADF (left or right) failure
AILERON LOCKOUT	108	A/S	**AB 308 p. 145**	Any aileron lockout actuator inoperative; or unlocked when commanded to be locked; or locked when commanded to be unlocked.
AIRSPEED LOW >	138	C		Airspeed is in the lower amber band
ALT ALERT SYS	71	S		Input loss or failure of the altitude alert system
ALTITUDE ALERT >	71	C		Deviation from selected MCP altitude by >=300 ft
ANTI ICE NAC ( )	200	S		Engine ( ) anti-ice valve not in commanded position, or TAI regulator valve failure.
ANTI ICE WING L (R)	200	S		Left (or right) wing anti-ice valve not in commanded position
ANTI-ICE >	200	A/P		Any anti-ice system is selected ON and TAT higher than 12°C.
ANTI-ICE NAC >	200	A/P		Any nacelle anti-ice selected ON and TAT higher than 12°C and ice detector does not detect ice.
ANTI-ICE WING >	200	A/P		Any wing anti-ice selected ON and TAT higher than 12°C and ice detector does not detect ice.
ANTISKID	206	A/S	**AB 313**	Antiskid fault in brake system currently in use (normal or alternate). Inhibited bu ANTISKID OFF message.
ANTISKID OFF	206	A/S		Antiskid unpowered on all wheels, or parking brake valve is not fully open when commanded open, or loss of both inputs from brake system control unit (BSCU).
APU	75	A/S	**AB 300 p. 145**	APU automatic fault shutdown with APU selector at ON, or else in OFF position and N1 > 95% with no fault indicated
APU FIRE LOOP ( )	99	S	**p. 145**	APU fire loop (A or B) fault output or fire
APU GEN 1	92	S		Aux generator control relay 1 open and APU running
APU RUNNING	75	M		APU is running with APU selector at ON and N1>95%
APU STRT INHIBIT	75	S		Next APU start inhibited due to a detected fault
ATC ( )	82	S		ATC transponder (left or right) inoperative
AURAL SYNTH CARD	237	S		Failure of left or right aural synthesiser card in MAWEA (modular avionics and warning electronics assembly)
AURAL WARN SPKR	237	S		Failure of left or right aural warning speaker
AUTOBRAKES	206	A/S	**AB 313**	Autobrake is disarmed or inoperative, or solenoid valve is open with autobrake selected OFF.
AUTOBRAKES ( )	206	M		Autobrakes selector positioned to 1, 2, 3, or 4
AUTOBRAKES MAX	206	M		Autobrakes selector positioned to MAX
AUTOBRAKES RTO	206	M		Autobrakes selector positioned to RTO
AUTOPILOT >	71	C		Active autopilot not receiving required inputs (or in ground test)
AUTOPILOT DISC >	71	W		All engaged autopilots have been disconnected
AUTOSTART OFF >	224	A/P		Autostart switch is OFF
AUTOTHROT DISC >	71	C		Autothrottle system has been disconnected, or failure to disconnect power from autothrottle servo
AUTOTHROT DISC >	224	C		Autothrottle system has been disconnected, or failure to disconnect power from autothrottle servo
BAT CHARGER APU	92	S		APU battery overheat, or charger failed, or input power failed, or interlock open
BAT CHARGER MAIN	92	S		APU battery overheat, or charger failed, or input power failed, or interlock open
BAT DISCH APU >	92	A		APU battery discharging (inhibited during APU start)
BAT DISCH MAIN >	92	A		Main battery discharging
BATTERY OFF >	92	A	OFF light	Battery switch is OFF

Message	Page	Type	Ind	Comment
BLD ( ) OVHT/PRV	214	A	SYS FAULT light	Bleed air overheat engine ( ) and pressure regulator valve and high pressure shutoff valve closed. Or, pressure regulator failed to close.
BLD DUCT LEAK ( )	214	C/S	**AB 295**	Leak or overheat in left, centre, or right bleed air duct.
BLEED ( ) OFF	214	A	OFF light	Engine ( ) pressure regulator and shutoff valve closed with engine running and bleed commanded OFF.
BLEED ( ) OVHT	214	S	**AB 296**	Bleed air overheat switch actuated commanding engine ( ) pressure regulating valve and high pressure shutoff valve to close
BLEED LOSS APU	214	S		Loss of APU bleed air
BODY GEAR STRG >	206	A		System is not armed and any body gear steering actuator is unlocked or pressurised
BODY GR STRG SYS	206	S		Fault detected in body gear steering system
BOTTLE LO APU >	99	A		APU fire extinguisher bottle pressure is low
BOTTLE LOW APU	99	S		APU fire extinguisher bottle pressure is low
BRAKE LIMITER	206	A/S		Brake torque limiter failure, or parking brake valve is not fully open when commanded open, or loss of both inputs from brake system control unit (BSCU)
BRAKE SOURCE >	206	C	BRAKE SOURCE lt	All three hydraulic brake pressure sources (hydraulic systems 1, 2, and 4) have low pressure.
BRAKE TEMP	206	A	**AB 313**	Any brake temperature is above 4 units.
BTL LO ( ) ENG ( ) >	99	A/P	BTL DISCH	Bottle A or B in respective engine has low pressure
BTL LOW ( ) ENG ( )	99	S/P		Bottle A or B in respective engine has low pressure
BUFFER FULL, MSG NOT GEN	82	SCR		The SEND line select key was pushed, but there is not enough memory available for downlink to ground station. Wait until communication is available.
CABIN ALT AUTO	214	C		Both pressure controllers inoperative or manual mode selected
CABIN ALT AUTO ( )	214	S		Pressure controller (A or B) inoperative
CABIN ALTITUDE	214	W	**AB 293** **p. 145**	Cabin altitude exceeds 10,000 feet
CARGO DET AFT ( )	99	S		Loop A and loop B in aft zone (3 or 4) both failed
CARGO DET FWD ( )	99	S		Loop A and loop B in aft zone (1 or 2) both failed
CHECK ALT TGT	145	SCR		VNAV is engaged whilst the aircraft is between the MCP altitude and the cruise altitude or altitude constraint of the FMC. VNAV holds level flight. Both target altitudes must be set above or below the aircraft.
CON IGN ENG ( )	224	S		No continuous ignition on engine ( )
CON IGNITION ON	224	M		Continuous ignition system switch is pushed ON
CONFIG FLAPS >	237	W		Take-off thrust selecgted on engine 2 or 3 and flaps not in take-off position
CONFIG GEAR >	237	W		Gear not down and locked with landing flaps selected or with aircraft below 800 feet RA while any throttle is retarded below 56° thrust lever angle.
CONFIG GEAR BRK >	237	W		Take-off thrust selected on engine 2 or 3 and parking brake set
CONFIG GEAR CTR >	237	W		Take-off thrust selected on engine 2 or 3 and any body gear steering actuator unlocked
CONFIG SPOILERS >	237	W		Take-off thrust selected on engine 2 or 3 and speedbrake lever not in Down detent
CONFIG STAB >	237	W		Take-off thrust selected on engine 2 or 3 and stabilizer not in selected greenband
CPCS BACKUP SENS	214	S		Cabin altitude backup signals differ by more than 800 feet
CREW OXY LOW >	50	A		Crew oxygen pressure at or below minimum
CREW RST OXY ON	50	A		Mobile crew rest oxygen system activated
DELETE	146	SCR		The DEL key is pushed and line deletion is armed.
DET FIRE / OVHT ( ) >	99	A		Engine fire loop A or B failed for overheat or fire
DET FIRE APU >	99	A		APU fire loop A or B failed for overheat or fire
DISCONTINUITY	145	SCR		LNAV is engaged and the aircraft has entered a route discontinuity. LNAV maintains the last heading.

Message	Page	Type	Ind	Comment
DME ( )	138	S		DME (left or right) failure
DOOR AFT CARGO	50	C/S		Aft cargo door not locked closed
DOOR BULK CARGO	50	A		Bulk cargo door not locked closed
DOOR ELEC CTR	50	A		Centre electrical access door not locked closed
DOOR ELEC MAIN	50	A		Main electrical access door not locked closed
DOOR ENTRY L ( )	50	A		Left ( ) entry door not locked closed
DOOR ENTRY R ( )	50	A/P		Right ( ) entry door not locked closed
DOOR FWD CARGO	50	C/S		Forward cargo door not locked closed
DOOR NOSE CARGO	50	C/S/P		Nose cargo door not locked closed
DOOR SIDE CARGO	50	C/S/P		Main deck side cargo door not locked closed
DOORS AUTO	50	M/P		All entry and upper deck doors are in automatic mode (inhibited after take-off thrust is applied until 1 minute after landing).
DOORS AUTO/MAN	50	M/P		Entry and upper deck doors are in mixed modes
DOORS ELEC	50	A		Both electrical access doors not locked closed
DOORS ENTRY L	50	A		Two or more left entry doors not locked closed
DOORS ENTRY R	50	A/P		Two or more right entry doors not locked closed
DOORS MANUAL	50	M/P		All entry and upper deck doors in manual mode
DRAG REQUIRED	145	SCR		VNAV is engaged and the speedbrakes are required, or autothrottles are off and less thrust is required to maintain the selected VNAV descent path.
DRIVE ( ) TEMP SNS	92	S		IDG ( ) temperature sensor failed. Temperature rise reads > 49°C.
DRIVE DISC ( )	92	S		Drive ( ) disconnect switch pressed and frequency below 100 Hz
DRIVE DISC ( ) >	92	A		Drive ( ) disconnect switch pressed and frequency below 200 Hz (inhibits ELEC DRIVE message).
DUCT LEAK ( ) LP A	214	S		Duct leak (left, centre, or right) loop A overheat or fault
DUCT LEAK ( ) LP B	214	S		Duct leak (left, centre, or right) loop B overheat or fault
EE CLNG EXH FAN	214	S		Equipment cooling air exhaust fan has failed
EE CLNG GND EXH	214	S		Ground exhaust valve disagrees with commanded position
EE CLNG INBD EXH	214	S		Equipment inboard exhaust valve disagrees with commanded position
EE CLNG OVRD	214	S		System in override mode and no flow through main rack. Or airborne and system in clean mode for longer than 3 minutes.
EE CLNG SUP FAN	214	S		Equipment cooling air supply fan has failed
EE CLNG SUPPLY V	214	S		Equipment supply valve disagrees with commanded position
EFIS CONTROL ( )	138	S		EFIS control panel (left or right) failure
EFIS CONTROL ( ) >	138	A		EFIS control panel (left or right) is inoperative. TCAS information can no longer be displayed on the ND.
EIU ( )	138	S		EIU (left, centre, or right) inoperative
EIU DISAGREE	138	S		Disagreement between displayed and computed engine parameter, or analogue variable or ARINC bus disagreement between any EIUs.
EIU LEFT >	138	A		Left EIU failed, or left EIU off whilst aircraft is on the ground.
ELEC AC BUS ( )	92	C	ISLN light OFF light **AB 301**	AC bus ( ) unpowered (inhibits ELEC GEN OFF and ELEC BUS ISLN messages).
ELEC ARINC LINK	92	S		Any ARINC link BCU to GCU, or BCU to BCU, is inactive
ELEC BCU 1 (or 2)	92	S		Bus control unit 1 (or 2) off or failed; or ARINC data bus to EFIS/EICAS interface unit failed; or hot battery or 28B battery failure; or DC load shed 1 (or 2) failed.
ELEC BTB ( )	92	S		Bus tie breaker ( ) failed.
ELEC BUS ISLN ( )	92	A	ISLN light **AB 301**	Bus tie breaker ( ) open (inhibited during Autoland)

Message	Page	Type	Ind	Comment
ELEC DRIVE ( )	92	A	DRIVE light **AB 302** **p. 145**	Integrated drive generator ( ) low oil pressure; or oil temperature above 185°C and engine ( ) running
ELEC DRIVE ( )	92	S	**AB 302** **p. 145**	Integrated drive generator ( ) low oil pressure; or oil temperature above 157°C for ten minutes and engine ( ) running
ELEC GEN OFF ( )	93	C	OFF light **p. 146**	Generator breaker ( ) open and engine ( ) running
ELEC GEN SYS ( )	93	S		IDG ( ) failure; or generator ( ) feeder failure; or GCU ( ) failed or off; or GCB ( ) failed; or 28V backup failure; or ARINC bus from GCU ( ) to BCU 1 or 2 failed
ELEC SSB OPEN >	93	A		Split system breaker open when commanded closed
ELEC UTIL BUS L	93	A	OFF light **AB 302** **p. 146**	Utility bus 1 or 2, or galley bus 1 or 2 unpowered (not load shed).
ELEC UTIL BUS R	93	A	OFF light **AB 302** **p. 146**	Utility bus 3 or 4, or galley bus 3 or 4 unpowered (not load shed).
EMER LIGHTS	51	A		Emergency lights switch is not in ARMED position, or in ARMED position and emergency lights activated by cabin attendant switch
END OF ROUTE	145	SCR		End of active route overflown with LNAV engaged. LNAV maintains last heading.
ENG ( ) EEC MODE >	224	A	ALTN light	Electronic engine control ( ) is in alternate mode
ENG ( ) FAIL	224	C	**p. 146**	Flameout detected in engine ( )
ENG ( ) FIRE LP ( )	99	S		Engine ( ) fire loop A or B fault output or fire
ENG ( ) FUEL VLV	224	A/S		Engine ( ) fuel valve or spar valve not in commanded position
ENG ( ) IGNITER 1 (2)	224	S		Engine ( ) unable to ignite using igniter 1 (or 2)
ENG ( ) LIM PROT >	224	C		Engine ( ) control is alternate mode and N1 RPM exceeds maximum rating
ENG ( ) OIL PRESS	224	A/S	**AB 305** **p. 146**	Engine ( ) oil pressure is below operating limit and engine is running
ENG ( ) OIL TEMP	224	A	**AB 306** **p. 146**	Engine ( ) oil temperature has reached the red line limit
ENG ( ) OVHT LP ( )	99	S	**p. 146**	Engine ( ) nacelle overheat detector loop A or B fault output or overheat
ENG ( ) REVERSER	224	S		Engine ( ) thrust reverse system malfunction
ENG ( ) SHUTDOWN >	224	C	**p. 146**	Engine ( ) fuel control switch is in CUTOFF mode or file switch is pulled. Message does not activate master caution light or caution beeper. Inhibits other engine-related messages.
ENG IGNITION	224	A		No continuous ignition on all four engines
ENTER IRS POSITION	145	SCR		IRS aligning and position entry in page POS ½ required, or sine/cosine comparison test detected disagreement between the set and the last position. The aircraft should be within about 60 NM from the last position.
EQUIP COOLING	214	C	**AB 296** **p. 147**	Low flow or smoke or over-temperature in equipment cooling system, or valve system disagrees with commanded configuration
EQUIP LOW FLOW	214	S		Low flow in equipment cooling air supply duct
EQUIPMENT SMOKE	214	S		Smoke detected in equipment cooling air exhaust
EQUIPMENT TEMP	214	S		Over-temperature in equipment cooling air supply
FIRE APU	99	W	APU light **AB 300**	APU fire detected
FIRE ENG ( )	99	W	( ) light **AB 303** **p. 147**	Engine ( ) fire detected
FIRE TEST FAIL >	99	W		Any fire/overheat test discrete has failed during test, or discretes set in test disagree with aircraft model
FIRE TEST PASS >	99	W		All fire/overheat test discrete true during test, and fire configuration agrees with aircraft model

Message	Page	Type	Ind	Comment
FIRE WHEEL WELL	99	W	**AB 314**	Fire detected in wheel well
FLAP RELIEF >	108	A		Flap load relief in progress
FLAP SYS MONITOR	108	S		Flap control unit failure or sensor fault
FLAPS CONTROL	108	C	**AB 307** **p. 147**	Alternate flaps are armed; or an EICAS interface has failed. All flap control units (FCUs) are disconnected from flap system (inhibits FLAPS PRIMARY and FLAPS DRIVE messages).
FLAPS DRIVE	108	C	**AB 307** **p. 147**	Trailing edge flaps asymmetry; or any flap shut down; or any electrically driven flap disagrees with its commanded position (inhibited by FLAPS CONTROL message).
FLAPS PRIMARY	108	C	**AB 307** **p. 147**	Any trailing edge hydraulic flap or any leading edge pneumatic flap disagrees with commanded position (inhibited by FLAPS CONTROL and FLAPS DRIVE).
FMC ( )	138	A/S		Flight Management Computer (left or right) inoperative
FMC ( )	179	A/S		Flight Management Computer (left or right) inoperative
FMC MESSAGE >	138	A	MSG light	High priority message displayed in CDU scratchpad
FMC MESSAGE >	179	A	MSG light	High priority message displayed in CDU scratchpad
FSMC A (or B)	186	S		Fuel system management card (FSMC) A or B inoperative
FUEL BALLAST >	186	C/P		(Combi only) Fuel quantity in centre tank is equal to or less than fuel ballast value entered in FMC PERF INIT page and centre tank pumps are running.
FUEL DISAGREE — PROG 2/2	145	SCR	**AB 310** if leak susp or confirmed	Difference of 9000 lbs / 4080 kgs or more between totalizer and calculated fuel quantity. Selection of a USE prompt in the PROG 2/2 page required.
FUEL IMBAL 1-4 >	186	A	**AB 310** if leak susp or confirmed	Fuel difference of 3000 lbs / 1360 kgs between main tanks 1 and 4. Message is removed when difference is decreased to below 1000 lbs / 450 kgs.
FUEL IMBAL 2-3 >	186	A	**AB 310** if leak susp or confirmed	Fuel difference of 6000 lbs / 2720 kgs between main tanks 2 and 3. Message is removed when difference is decreased to below 1000 lbs / 450 kgs.
FUEL IMBALANCE >	186	A	**AB 310** if leak susp or confirmed	Fuel difference of 6000 lbs / 2720 kgs between inboard and outboard tanks after reaching “fuel tank to engine” condition. Message is removed when difference is decreased to below 1000 lbs / 450 kgs.
FUEL JETT A (or B)	186	S		Jettison system A (or B) inoperative
FUEL JETT A (or B) >	186	A		Jettison system A (or B) inoperative
FUEL JETT SYS	186	C		Both jettison systems have failed, or any nozzle valve is open while total fuel is less than fuel to remain value.
FUEL OVRD 2 (3) AFT	186	A/S	PRESS light	Aft override pump 2 (or 3) has low pressure when commanded to run (advisory and status), or switched OFF and main tanks not equal (advisory only).
FUEL OVRD 2 (3) FWD	186	A/S	PRESS light	Forward override pump 2 (or 3) low pressure when commanded to run (advisory and status), or switched OFF and main tanks not equal (advisory only).
FUEL OVRD CTR L (R)	186	A/S	PRESS light	Left (or right) centre pump has low pressure when commanded to run (advisory and status), or centre tank pump switched ON and fuel in centre is less than 6000 lbs / 2720 kgs, or greater with pumps switched OFF(advisory only).
FUEL PMP STAB L (R)	186	A/S/P	PRESS light	Left (or right) stabilizer tank pump has low pressure when commanded to run (advisory and status), or switched OFF and fuel in stabilizer is less than 6000 lbs / 2720 kgs (advisory only).
FUEL PRESS ENG ( )	186	C	PRESS light **AB 309**	Crossfeed valve ( ) is closed while both pumps in tank ( ) have low pressure.
FUEL PUMP ( ) AFT	186	A/S	PRESS light	Output pressure in fuel pump aft ( ) is low. Inhibited by FUEL PRESS ENG ( ) message. Status message is displayed if pump switch is ON.

Message	Page	Type	Ind	Comment
FUEL PUMP ( ) FWD	187	A/S	PRESS light	Output pressure in fuel pump forward ( ) is low. Inhibited by FUEL PRESS ENG ( ) message. Status message is displayed if pump switch is ON.
FUEL QTY LOW	187	C	**AB 310**	Less than 2000 lbs / 900 kgs in any main tank.
FUEL QTY SYS	187	S		Fuel quantity processor or input/output interface inoperative.
FUEL RES XFR 2 (or 3)	187	A		Reserve tank 2 (or 3) transfer valves are closed when commanded open.
FUEL SCAV PUMP	187	S		Fuel scavenge pump or pressure switch inoperative.
FUEL TANK/ENG >	187	A		Main tank 2 or 3 equal to or less than quantity in main tank 1 or 4 and crossfeed valves 1 or 4 not closed.
FUEL TEMP LOW >	187	A		Fuel temperature is less than -37°C
FUEL X FEED ( )	187	A/S	VALVE light	Fuel crossfeed valve ( ) disagrees with commanded position.
FUEL XFER 1 + 4 >	187	A		Gravity transfer switch is ON while inboard tank quantities are greater than outboard quantities or while aircraft is on ground.
FUEL XFR VLV 1 (or 4)	187	S		Main tank 1 (or 4) gravity transfer valve closed when commanded open by jettison system or manual switch.
GEAR DISAGREE	206	C/S	**AB 314**	Both primary and alternate systems indicate any gear disagrees with commanded position
GEAR DOOR	206	A/S		Both primary and alternate systems indicate any gear door open when commanded closed. Inhibited when alternate gear extend is activated.
GEAR TILT	206	C/S		Aircraft is airborne and both primary and alternate systems indicate any gear is not tilted
GND PROX SYS	237	S		Ground proximity warning system or left radio altimeter has failed
GND PROX SYS >	237	A		Ground proximity warning system or left radio altimeter has failed
HEAT L (R) AOA	200	A/S		Left (or right) angle of attack probe heat failure
HEAT L (R) TAT	200	A/S		Left (or right) total air temperature probe heat failure
HEAT P/S CAPT (F/O)	200	A/S		Captain's (or First Officer's) main pitot heat failure
HEAT P/S L (R) AUX	200	A/S		Left (or right) auxiliary pitot heat failure
HEAT WINDOW L (R)	200	A/S		Left (or right) window heater, controller, or sensor failure; or switch is OFF.
HIGH ALT LDG	215	S		High altitude landing primary relay has failed
HYD CONTROL 1 (or 4)	195	A		Hydraulic interface module 1 (or 4) has failed. Automatic demand pump functions and/or hydraulic system indications may be inoperative.
HYD OVHT SYS ( )	195	A/S	SYS FAULT light **AB 311**	Engine driven pump or demand pump or auxiliary pump case drain temperature above 105°C
HYD PRESS DEM ( )	195	A/S	PRESS light **AB 311**	Demand pump selector ( ) is OFF, or demand or auxiliary pump output pressure is less than 1400 psi when commanded to run. (Inhibited by HYD PRESS SYS message).
HYD PRESS ENG ( )	195	A/S	PRESS light **AB 311**	Engine driven pump ( ) output pressure is less than 1400 psi (inhibited by HYD PRESS SYS message)
HYD PRESS SYS ( )	195	C	SYS FAULT light **AB 312**	Pressure in hydraulic system ( ) less than 1200 psi
HYD QTY LOW ( ) >	195	A	SYS FAULT light	Hydraulic fluid quantity in system ( ) helow 0.35
HYD RSVR PRESS ( )	195	S		Hydraulic reservoir ( ) bleed air pressure is less than 22 psi
HYDIM ( )	195	S		HYDraulic Interface Module (HYDIM) 1,2,3 or 4 is inoperative.
ICING NAC >	200	C/P		Nacelle ice detected and any nacelle anti-ice system is OFF while airborne.
ICING WING >	200	A/P		Wing ice detected and any wing anti-ice system is OFF while airborne.
ILS ( )	138	S		ILS (left, centre, or right) failure

Message	Page	Type	Ind	Comment
ILS TUNE INHIBITED — MCP	145	SCR		A change in ILS tuning or a selection of a new approach is attempted, and FOCs do not allow a frequency change for safety reasons. Both F/Ds and all A/Ps must be disengaged first, or TOGA must be selected.
INSUFFICIENT FUEL	145	SCR		Estimated fuel remaining at destination is less than the value entered in the RESERVED line on the POS INIT page.
INVALID DELETE	146	SCR		A line deletion has been attempted, but the line in question can not be deleted.
INVALID ENTRY	146	SCR		An entry has been attempted with an incorrect format or range, or the entry is not allowed.
IRS ( )	138	A/S		IRU (left, centre, or right) failed
IRS AC ( )	138	S		AC power to IRU (left, centre, or right) failed
IRS AC ( ) >	138	A		AC power to IRU (left, centre, or right) failed
IRS ALIGN MODE ( )	138	M		IRS (left, centre, or right) in align mode. Initial attitude mode selected
IRS DC ( )	138	S		DC power to IRU (left, centre, or right) failed
IRS DC ( ) >	138	A		DC power to IRU (left, centre, or right) failed
IRS MOTION	138	A		Aircraft motion detected by any IRU during alignment. Alignment continues only when the aircraft has stopped.
IRS NAV ONLY	145	SCR		FMS has been navigating without continuous radio updating above 15,000 feet for more than 12 minutes, or below 15,000 feet for 10 minutes, or descending through 15,000 feet and no radio update since last message.
IRS POS/ORIGIN DISAGREE	145	SCR		Active origin airport entered in the RTE page disagrees with the IRS position.
JETT NOZ ON >	187	A		Both nozzle valves are open
JETT NOZ ON L (or R)>	187	A		Left (or right) nozzle valve is open
JETT NOZZLE L (or R)	187	S		Left (or right) nozzle valve disagrees with commanded position.
JETT NOZZLE L (or R)>	187	A	VALVE light	Left (or right) nozzle valve disagrees with commanded position.
KEY/FUNCTION INOP	146	SCR		The selected key is inoperative in the installed FMC software version.
LANDING ALT	215	A	**AB 297**	FMC landing altitude disagrees with target altitude of cabin pressure control system
LAV-GALLEY FANS	215	S		Both lavatory/galley vent fans have failed
LE MULT DRIVE	108	S		Multiple leading edge drive mode failures
LWR PRESS RELIEF	215	S		Lower pressure relief valve is actuated
MAX ALT FLxxx	146	SCR		An entry of a cruise altitude higher than the performance maximum altitude has been attempted. xxx is the current maximum Flight Level.
NAC TEMP ENG ( )	99	S/P		Engine ( ) nacelle temperature higher than 170°C; or N1 on all engines > 60% and equalised within 5% and any nacelle differs by more than 50°C.
NAI DUCT ( ) LEAK	200	S		Engine ( ) fan cowl temperature higher than 120°C
NAI VALVE ( )	200	A		Engine ( ) anti-ice valve not in commanded position with engine running
NO ACTIVE ROUTE	145	SCR		LNAV selection is attempted but no active route is available.
NO AUTOLAND	71	S		Loss of autoland system
NO AUTOLAND >	71	A		Loss of autoland system prior to approach
NO AUTOLAND >	71	C		Loss of autoland system during approach between 1500 and 200 feet (inhibits NO AUTOLAND “A”)
NO LAND 3	71	S		Degradation in autoland system
NO LAND 3 >	71	A		Degradation in autoland system prior to approach
NO LAND 3 >	71	C		Degradation in autoland system during approach between 1500 and 2000 feet (inhibits type “A”)
NO SMOKING ON	51	M		NO SMOKING signs are manually selected ON
NOT IN DATABASE	146	SCR		An entry of an identifier has been attempted, but information is not found in the database.

Message	Page	Type	Ind	Comment
NOT IN INTERCEPT HEADING	146	SCR		LNAV is selected and the aircraft is not on a heading which will intercept the active leg.
OVERSPEED >	237	W		Left, centre, or right ADC airspeed exceeds V_{MO}/M_{MO}
OVHT ENG ( ) NAC	99	C	**AB 306**	Overheat detected in engine ( ) nacelle
PACK ( )	215	A	SYS FAULT light **AB 297 p. 148**	Pack (1, 2, or 3) is selected ON, but pack is inoperative
PACK ( )	215	S	**AB 297 p. 148**	Pack (1, 2, or 3) system failure or overheat
PACK ( ) OFF	215	M		Pack ( ) selected OFF. Inhibited by "PACK ( )" advisory message
PACK HIGH FLOW	215	M		Packs high flow mode manually selected
PARK BRAKE SET	206	M		Parking brake is set
PASS OXY LOW	51	A		Passenger oxygen pressure at or below 1600 psi
PASS OXY REFILL	51	S		Passenger oxygen pressure at or below 1600 psi
PASS OXYGEN ON	51	A/S		Passenger oxygen system has been activated
PASS SERVICES	51	S		Cabin services system failure
PASS SIGNS ON	51	M		Both NO SMOKING and SEATBELTS selectors are manually selected ON
PERF/VNAV UNAVAILABLE	145	SCR		VNAV selection is attempted, but cruise altitude, cost index, or gross weight is not entered, or gross weight is not confirmed and displayed in large font.
PRINTER BUSY PRINTER NO PAPER PRINTER OFF PRINTER TIMEOUT	82	SCR		PRINT line select key pushed but printer not ready
PVD CAPT ON	138	M/P		Captain's paravisual display unit is enabled. No failures detected.
PVD SYS CAPT	138	S		Captain's paravisual display unit has failed. Message is displayed whether PVD is selected off or on.
PVD SYS CAPT >	138	A		Captain's paravisual display unit selected on and system has failed.
RADIO ALT ( )	139	S		Radio altimeter (left, centre, or right) inoperative
RECIRC FAN LWR L (R)	215	S		Lower left (or right) recirculation fan inoperative
RECIRC FAN UPR L (R)	215	S		Upper left (or right) recirculation fan inoperative
RES ( ) XFR VLV	187	S		Reserve tank (2A, 2B, 3A, or 3B) transfer valve disagrees with commanded position.
RESET MCP ALT	145	SCR		Two minutes to go to top of descent (T/D) and MCP altitude is not set below the FMC cruise altitude.
ROUTE FULL	146	SCR		A route modification has been attempted which would overfill the FMC waypoint capacity (max. 120 waypoints per route). The last selection is cancelled.
RUD RATIO DUAL	108	A		Both rudder ratio changer systems have failed.
RUDDER RATIO	108	S		Upper and/or lower rudder ratio functions failed, or both in one stab trim/rudder ratio module (SRM).
RUNWAY N/A FOR SID	146	SCR		The selected runway is not compatible with the selected SID. If that runway has been selected on the RTE page, the existing SID is deleted. If the runway has been selected on the DEPARR pages, the FMC does not accept that runway, and keeps the existing SID.
RW/ILS CRS ERROR	145	SCR		Disagreement between the selected ILS course and the course for the destination runway in the active route.
RW/ILS FREQ ERROR	145	SCR		Disagreement between the selected ILS frequency and the frequency for the destination runway in the active route.
SEATBELTS ON	51	M		SEATBELT signs are manually selected ON
SNGL SOURCE ILS >	139	C		Captain's and First Officer's PFD/ND on same glideslope source or on same localizer source
SNGL SOURCE RA >	139	C		Captain's and First Officer's PFD on same radio altimeter
SOURCE SEL IRS >	139	A		Captain's and First Officer's PFD/ND on same IRU

Message	Page	Type	Ind	Comment
SOURCE SEL NAV >	139	A		Captain's and First Officer's ND on same FMC or same CDU
SPEEDBRAKE AUTO	108	A/S	**AB 308** **p. 148**	Auto-speedbrake actuator is not retracted with lever not armed; or air/ground disagreement; or control circuit fault.
SPEEDBRAKE EXT >	108	A/S		Speedbrakes are extended with throttles out of idle, or with aircraft between 15 and 800 feet radio altitude, or with flaps set to 25 or 30°.
SPLIT IRS OPERATION	145	SCR		FMCs have changed position updating mode from triple-mixed to single-source. Cause: aircraft operating in polar latitudes, or IRU failure, or a significant difference in IRU positions.
STAB AUTO TRIM	108	S		Fault detected in auto stabilizer drive system
STAB GREENBAND	108	S		Nose gear oleo pressure switch disagrees with selected greenband, or invalid CG entered in CDU
STAB GREENBAND >	108	A		Nose gear oleo pressure switch disagrees with selected greenband, or invalid CG entered in CDU
STAB TRIM 2 (or 3) >	108	A		Hydraulic system 2 (or 3) stabilizer drive is inoperative. Stabilizer drive speed is 50% slower.
STALL WARN SYS	108	S		Stall warning system inoperative
STANDBY ONE	146	SCR		FMC requires more than 6 seconds to display the desired data.
STBY BUS APU .	93	A		APU standby bus unpowered
STBY BUS MAIN >	93	A		Main standby bus unpowered
STBY IGNITION ON	224	M		Standby ignition is manually selected ON.
STBY POWER OFF >	93	A		Standby bus unpowered
STROBE LIGHT OFF	51	M		Strobe lights are OFF in flight
TAKE-OFF SPEEDS DELETED	145	SCR		FMC validation check or selected performance data made the previously entered V-speeds invalid. Reselect V speeds in the TAKE-OFF page.
TCAS OFF >	237	A		TCAS is selected OFF. Inhibited by advisory message ">TCAS SYSTEM"
TCAS SYSTEM	237	S		TCAS system has failed.
TCAS SYSTEM >	237	A		TCAS system has failed. TCAS resolution advisories cannot be displayed on the EFIS displays
TE FLAPS	108	S		Trailing edge flaps system failed
TEST IN PROG >	99	W		Fire/overheat system test in progress
THRUST REQUIRED	145	SCR		VNAV is engaged and autothrottles are disengaged and additional thrust is required to maintain selected descent path and speed.
TIRE PRESSURE	206	S		Any tyre has abnormal pressure. Inhibited by "> TIRE PRESSURE" caution message.
TIRE PRESSURE >	206	C		Any tyre has abnormal pressure
TRANSPONDER >	82	A		ATC transponder (left or right) inoperative
TRIM AIR OFF >	215	A		Master trim air valve commanded closed, or over-temperature in system. All passenger zones are maintained at an average temperature of 24°C.
UNABLE CRZ ALT	146	SCR		The entered cruise altitude results in an intersection between the climb and descent path. The entered cruise altitude cannot be reached.
UNABLE NEXT ALT	145	SCR		VNAV is engaged and the available climb gradient is not great enough to reach the next waypoint climb constraint. Undershoot errors are displayed on the VNAV CLB page.
UPR PRESS RELIEF	215	S		Upper pressure relief valve is actuated
VOR ( )	139	S		VOR (left or right) failure
WAI VALVE LEFT	200	A	VALVE light **AB 299**	Left wing anti-ice valve not in commanded position
WAI VALVE RIGHT	200	A	VALVE light **AB 299**	Right wing anti-ice valve not in commanded position
WNSHR ALERT SYS	237	S		Windshear alert function is inoperative
WNSHR ALERT SYS >	237	A		Windshear alert function is inoperative

Message	Page	Type	Ind	Comment
XFEED CONFIG >	187	A		Crossfeed valve 1 or 4 closed and main tanks not equal; or crossfeed valve 2 or 3 closed and flaps not in take-off position.
YAW DAMPER LWR	108	S		Lower yaw damper is inoperative
YAW DAMPER LWR >	108	A		Lower yaw damper is inoperative
YAW DAMPER UPR	108	S		Upper yaw damper is inoperative
YAW DAMPER UPR >	108	A		Upper yaw damper is inoperative
ZONE TEMP	215	S		Malfunction in zone temperature system.

RETS' ABNORMAL CHECKLIST COMMENTS

AILERON LOCKOUT: This message warns you that the outboard ailerons have either failed to lockout when commanded, or unlock when commanded. The outboard ailerons are commanded to lockout when the flaps are retracted, and then unlock when the flaps are extended. If this occurs, the 20 kt crosswind limit is really applicable to the 'fail to unlock' case, as full roll authority may not be available. The "limit inputs at high indicated airspeed" is for the 'fail to lockout' case, as roll rate would be excessive at high indicated airspeeds. One last thing to consider is that the autopilot may not make a smooth intercept with the localizer if the ailerons remain locked out, so your intercept angle should be kept small.

APU: This message is not a real major problem: you can most always get ground power and usually pneumatics as long as you give Ground a bit of notice. But chances are you will see this message at the end of a 13 hr sector when you try to start the APU after turning off the runway. Why? One cause is Cold soak to the APU. It's been sitting there not doing anything for 13 hours at temperatures of about minus 50 degrees. So if you have to pull up at the gate with no APU and no ground power in sight, shut down 1/2/3 and leave 4 running to provide power and pneumatics while you get the Passengers off and wait for power (or in the Sim just go to Preflight Items on the Instructor's Page and give yourself some ☺).

APU FIRE: Not a lot you can do about this other than follow the checklist and go home. One consideration, though, is to switch off the APU bleed air after running the checklist (just plugging holes that smoke can enter the system through) — *then* go home.

CABIN ALTITUDE: Alright — remember: 'Sit on your hands and assess the situation'. This is a classic example. Notice the second item of the checklist "Cabin altitude and rate". If the cabin is at 10200' and the rate is 400'/min climb (in the real world your popping ears would have alerted you to the change earlier) this isn't a really major problem since you have some time to think about what's going on. I've seen many crews during training rocket on down on an Emergency Descent in this situation (I've done it myself :-)) when it might just be a Duct leak, so look again at the EICAS and see what other messages are displayed (for example, a door warning is not a good sign). If the rate is above about 1000 ft/min, chances are you will be flying an Emergency Descent real soon. If the rate's off the clock don't mess around — get into the descent, close that thrust, get the brake out, and get going. If you follow your checklist and the situation stabilises it doesn't end there — now you have to start to think about your approach at the other end. Things to consider are —

- Longer running times for flaps (L/R duct leak): therefore start configuring for landing earlier.

- What if the leading edge flaps don't extend? Is there enough runway for a partial flap landing? (you will use about 450m additional runway to stop at V_{REF} +25). Also you won't have reverse thrust for braking (+200m). If you've just flown the Emergency Descent you now have a whole lot of other considerations.

ELECTRICAL DRIVE: Well, the Constant Speed Drive (CSD) is the generating part attached to the engine, and the reason for this message can be one of two things: first of all the CSD needs lubrication, and if the oil becomes too hot you'll have to disconnect it or it could disintegrate and take out the whole engine. Or, if the rise in temperature is very rapid but

within the max temperature, it will still need to be disconnected. Once you disconnect the CSD it can only be reset on the ground. Now you have 3 generators!

ELECTRICAL GENERATOR OFF: You will notice that the checklist says “Only attempt to reset the generator once”. This is because the frequency and/or voltage of the generator might not be normal, or else the generator has shorted out somehow and you could end up causing damage to other systems. If it won't reset, consider that the generator obviously has a problem, and watch out for a Electrical drive message and/or any abnormal engine indications on the associated engine.

ELECTRICAL UTILITY BUS: The same considerations apply to resetting this bus as above. The great thing about the 747 is its redundancy, so don't push your luck trying to fix things that aren't really messing up the operation as a whole.

Multiple ENGINE FLAMEOUT or stall: What's a stalled engine? What's a flameout? A flameout is pretty obvious, no fire in the burner any more. A stalled engine is characterised by no response to thrust lever movement, with higher than normal EGT (it's still burning). This is the reason why you select the fuel control switches to cutoff (to put the fire out and start it up again) — you could leave the fuel control switches where they are with a flamed out engine, and given the right conditions it should light up again (you have fuel and the ignition is now continuous). To successfully get a re-light without cranking the engines you need about 250kts above 15000' and 290kts below (RB211 engines — if anyone has CF6 figures let me know) so there you are with no engines descending to maintain speed for a re-light. Now start thinking about your options. What's the lowest safe altitude? What caused this? Could it be Volcanic ash? (see below). Also, as you start to get the engines back remember your asymmetric considerations and trim the aircraft. And get max continuous thrust set on the engines available to you.

ENGINE NACELLE OVERHEAT: The main thing to think about with this is that if the message goes you now have no anti-ice for that engine, so you must avoid icing conditions (TAT less than +10, SAT warmer than -40 with visible moisture) to avoid possible engine damage caused by icing.

ENGINE OIL PRESSURE & ENGINE OIL TEMPERATURE: Maybe an early discussion on this might give you the option of starting the engine again later in flight. It depends on the quantity of oil remaining and/or the temperature: better to do a 4 engine landing than a 3 engine one though. Again, engine out considerations apply here.

ENGINE FAILURE/SHUTDOWN: As you can see from the size of the checklist this is not a real emergency on a 4 engine aircraft, unless it occurs at a critical stage of flight like take-off on a performance limited runway. So once again take your time; identify the engine, and confirm that each action is for the applicable engine. Also, the same considerations as for engine fire are relevant here as regards fuel remaining and diversions. The other thing to consider is that it might be possible to restart the engine prior to your approach (if the reason for the shutdown was just precautionary) and make a normal no stress landing.
Engine in-flight start: First of all you need airspeed unless you want to try a X-bleed start (crank the engine): the 250kts above 15000' and 290kts below apply here (RB211, CF6?), so get it going early on the descent while you have speed. Once you get a light-off watch the EGT as the engine goes through the start cycle. It will come up then roll back before accelerating to the commanded thrust lever position.(something to think about during a multiple flameout scenario).

ENGINE FIRE (or severe damage): A real serious problem with a lot to consider. But the first thing to remember is not to rush in to the Recall Checklist. First of all, think of the aircraft's flight path and/or performance: for instance, after V1 you don't need to be pulling levers and calling out checklist commands while you're trying to get the aircraft safely into the air. I won't go too much into engine out handling here — it's more a topic for technique monthly — but suffice it to say Get airborne!, then clean the aircraft up and follow your departure. Now confirm which engine is affected: easy with a fire handle illuminated, but if it's severe damage have a good look, then action the checklist *confirming each selection is for the applicable engine*. If the problem occurs in the cruise leave the Autopilot in — it will cope with it, just make sure you trim the aircraft. Then think about your performance: are you above your max 3 engine altitude? If so you will have to initiate a driftdown procedure, so make sure you're getting max continuous thrust. Now the fire's out do you have fuel to make your destination at this lower level? Where can you divert if need be? What's the weather going to be like there? Also, monitor your electrical load as you're now on 3 generators. In the case that the fire continues (an uncontrollable engine fire) first of all you need to get on the ground soon, so start to check and select your divert options and get on to it. Also remember not to use speed brakes and flap until an emergency landing is imminent — you don't need flames and heat entering the wing cavities. But hopefully if you have a long way to go the engine will just burn itself out (no fuel source now the check list is complete) or fall off the wing ('separate', it's designed to do that).

EQUIPMENT COOLING: Down in the MEC (main electric compartment located under the floor of first class) the cooling blowers for the avionics blow air over the racks there and vent into the forward cargo hold. In the event of the blowers malfunctioning the air is vented overboard by using the pressure differential between the cabin and the outside to maintain airflow over the electrics (going to Override does this). So now you have a leak in the aircraft: it's worth considering the consequences of this. If for some reason you had 2 packs inoperative you might not be able to hold the differential and the cabin altitude will climb, causing you to descend to an altitude where you can maintain the cabin below 10000'. So can you still make your destination at this level? (an unlikely situation, but possible) or if the cooling message stays on you will have to divert — unless you like to navigate and fly approaches on the Stby compass and A/H.

FLAPS CONTROL: This message is displayed when the alternate flap system is armed and therefore inhibiting the 'flap primary' and 'flap drive' messages. It also lets you know that the FCU's are disconnected, and the alternate electric system is ready to be used. If this message appears without the alternate system armed it indicates an EICAS fault, and the flaps should run as commanded. Again, the above mentioned extension times are the limiting factor when running this checklist.

FLAPS DRIVE: this occurs when you get asymmetric trailing edge flap and the flap control unit (FCU) shuts down the drive — or when any electric flap disagrees with the commanded position. Flap asymmetry is the worst case here, as you may be left to fly a split flap, or even a zero flap landing. The reason you can't use the alternate flap extension in this case is there is because you have no asymmetry protection during alternate extension.

FLAPS PRIMARY: This message will appear any time the flaps don't move to their commanded position. If the Flaps fail to run look at the indications on the EICAS to see which flap sections are the problem (Inboard trailing edge, Outboard trailing edge or Leading edge flaps). Once that's sorted, follow the checklist and arm the Alternate flap system. The main consideration here is the time it takes to perform an alternate flap extension: for leading edge flaps it's only about 90 seconds, but for trailing edge flaps it's

about 6 minutes (!), so you must start to configure the aircraft early in the approach. For landing, use flaps 30, but you must watch the 160kt limit for flap 30 because the load relief system is not operational during alternate extension.

PACK: The ‘pack’ message isn't very descriptive, however if you follow the check list you should be able to solve the problem. But if you can’t and have to go to pack off you're still left wondering why. One possible reason is the sequencing of the inlet, bypass valve, and exit doors of the pack. If they aren't in sequence the pack will trip off. Here's an example of a pack inlet (small v shaped inlet: there are another two inlets on the other side of the aircraft). Another reason could be the temperature the Aircycle Machine is operating at, since if it reaches 85 degrees the pack will trip off. (The Air Cycle machine ‘ACM’ converts bleed air from the engines into usable air for pressurisation / Air-conditioning).

SPEEDBRAKE AUTOMATIC: As the checklist name implies, the normal automatic deployment of the speedbrake upon touchdown will not occur. So don't arm the speedbrake system for landing: use manual speedbrake extension instead. The thing to remember here is that performance manual landing data is based on the auto speedbrake working, so you must increase the landing distance required by 120m for flaps 30 and 185m for flaps 25. Also, the loss of this system could also be attributed to the landing gear tilt switch (this tells the aircraft when it’s on the ground), and you could have other problems — but these aren't modelled in the sim so I won’t go into them.

Non-checklist-specific items:—

EMERGENCY DESCENT: Firstly the configuration for the descent — and I know whatever I write here will create disagreement (as it does in real training sessions). But ultimately it comes down to how things are the day it happens. The way I recommend is, disengage the Autothrottle, close the thrust levers, raise the speed brake, then disengage the Autopilot and roll to 30 degrees as you ease forward on the controls to initiate the descent.

Target speed maintain? What's a good target? Well, that depends on the nature of the problem: if the aircraft's structure is damaged it might be worth descending at your present speed (it's held together OK up until now and might fall apart at higher speed) or if you consider it’s intact go at VMO following the limit on the speed tape. If, prior to starting your descent, you are close to your landing gear extend speed you might want to select the gear down and descend at the gear placard limit — although this causes you to spend more time at higher altitudes it makes for a shorter total descent time.

How far should you descend? This depends on a number of things: first of all, the Minimum Safe Altitude(MSA) — you will have to hold this until you're clear of terrain. Fuel considerations also play an important part once you’re down to a safe altitude for passengers without oxygen (about 14000') and fuel is tight: if it is, the FMC will remind you with the ‘fuel insufficient’ message so stay there until the crew oxygen is exhausted *then* drop down to 10000' for the remainder of the trip to a) your destination or b) an alternative airport. Now for your arrival at your destination: what other damage might there be? There could be damage to engines (from ingestion of cabin items), wing leading edges, control surfaces and about a thousand others you can think of. Luckily on the sim these are not featured, so just configure early and land.

SMOKE AIR-CONDITIONING: working down the checklist eventually brings you to the packs, and it’s a matter of working the checklist to find the pack that's causing the smoke (although the smoke might just be passing through that pack from another source). Once found, you then turn it off, but the checklist ends there — so you should start to think what caused the smoke? Are your engine indications normal? Check your ECS display on the EICAS — are indications normal? What about your Hydraulics: is one system leaking into the high stage compressor then through the packs? Can’t isolate it? Then it's probably worth landing as soon as you can. Maybe the smoke source wasn't the packs but it cleared by coincidence after you switched the pack off. Another judgement call I guess!

VOLCANIC ASH: Even though this isn't a recall checklist, you should have a pretty good idea of the procedure and get onto it quickly so the problems outlined below don't develop. The symptoms of volcanic ash are static discharges around the windshield or a bright glow around the engine intakes (St. Elmo’s fire), smoke or dust in the cockpit, or an acrid odour (hard to simulate but I'm sure Hardy's working on it ;-)). Once you establish this, start your 180 degree turn immediately and close the thrust: obviously the turn is to get out of the ash cloud, closing the thrust is to reduce the temperature EGT of the engine to reduce the amount of ash melting onto the turbine blades and combustion chamber walls. Putting the ignition on helps to prevent flameouts. The anti-ice and pack flow to hi is to bleed as much air as possible from the compressor to improve the stall margin of the engine. Alright, Checklist complete: in the worst case you might be doing a multiple engine flameout or stall checklist; looking for a divert airport in gliding distance; getting a couple of engines back on

line; — only to find on the approach that you can't see out of the windows because of the abrasive action of the ash on them. Then to top that, as you peer out a tiny area of clear side window at an unfamiliar airport making a side-slipping landing, you notice that the landing lights don't work too well because the lens covers are also opaque (this really happened to BA). Then again you could turn around, pop out of the bottom of the ash cloud, and pick another route that is reported as clear, with all systems normal.

TWO ENGINES INOPERATIVE: This discussion is really divided into three sections: first of all Take-off and V1 considerations, secondly Pre Approach, and thirdly the Two Engine Landing.

- *Take-off and V1 considerations*. The first thing to consider is that all your take-off calculations with regard to V1 are predicated on the loss of *one* engine only, and therefore the situation of losing two engines shortly after V1 might mean the discussion to continue the take-off is invalid since sufficient performance may not be available to get airborne in the take-off distance remaining. The next thing on your mind is the increase in the Minimum Control Speed (VMCA) with two engines inop on one side e.g. 1&2 out. Vmca varies with pressure, altitude, and temperature, and also the de-rate being applied to the take-off thrust (this sort of stuff might be better covered in Technique monthly); but for example at sea level , 15 degrees Celsius & Full rating thrust, Vmca with 1 eng inop is 112 kts, but 2 eng inop on the same side (Vmca2) is 154 kts, so you can see that at light weights you may have the performance to get airborne only to find that you don't have the airspeed to control the yaw forces being generated. So maybe with these considerations in mind it would be better to reject the take-off and possibly over-run the runway at relatively low speed than to impact off the runway at take-off speeds. You're the boss: it's your call.

- *Pre-approach*. The reason for having two packs selected off is to ensure minimum bleed air loss from your two remaining engines, giving them maximum available performance. Also, the "ground prox/flap override switch to override" inhibits the config warnings that will occur during the approach and landing, so it is important to remain vigilant about the landing gear position in this high workload situation! When selecting an airport to divert to, remember that this is an emergency procedure, so if the weather will allow a landing i.e. at or above the minima (not alternate requirements) with a landing distance suitable, *use that airport*. Overlying such airports in real life would require some explaining. OK, that said the first thing to do is obviously to run the checklists for the failed engines (these might be Engine fire, failure, or one of each). Now work through the other checklists — electrical, hydraulic etc. Then check the weather at your nearest airports, and once you've picked the nearest suitable, Divert. Now consider the fuel required to divert, and start to jettison fuel down to this level or lower (use the Fuel jettison checklist) as you reassess the fuel required. This will reduce your weight, giving you the performance to fly your approach on two engines. Now don't rush the approach, because once the gear is down you're committed to a landing, and as you can see there may be lots of other checklists to work through, not to mention controllability problems and the possibility of flap problems on approach — consequently with even more checklists to run. The normal config for the two engine ILS is flaps 5 once you are on an intercept heading to the localiser; then approaching the glideslope intercept flaps 10; upon intercept gear down. It is important to make sure you have a landing clearance before putting the gear down, because it's no good extending the gear only to find the runway blocked and not have the ability to go around! At 500 ft select flaps 20 and zero the rudder trim, and hold manual rudder pressure, once your touchdown target is

assured go to flaps **2**5 and land. During the approach airspeed control is extremely important: never let your airspeed get below the full manœuvring speed for your flap setting.

- *Two engine landing*. The touchdown target should be a minimum of 1000ft in from the threshold, and a large reduction in rudder should be anticipated as the thrust is reduced for landing. Reversers should still be brought to the interlock position, and only symmetrical reverse thrust applied. $\mathbf{V}_{REF}$ for flaps **2**5 is used for landing — plus it's worth having an additional 5 kts extra to ensure you don't drop below $\mathbf{V}_{REF}$.

Appendix 13: The Instructor's page

Here I'll go through some more of the items on the Instructor's page — you don't need this information right away, but it will be useful for you later, when you start to make changes to Situations before you run them. On page 20 when we discussed items on the Instructor's Page, I omitted some things which you would normally look at but were not needed for the Tutorial — and this is where I put them back again! When the time comes for you to make up your own flights, then the next couple of pages will give you the additional information you will need.

Pre-pre-flight preparation

If you are working with someone else's Situation then it should, if its creator was kind, have dealt with all of the items in this section. But Just In Case, as they say, (or come the day you want to make up your own) we'll run through them anyway — not least because you may want to vary some of the settings to suit your skill level, or nervousness. Or both. As usual, what follows assumes you may need to change everything, but just look and don't touch if you want to be faithful to your Situation's creator's whims. Or if you have faith, and you really prefer it all to come as a lovely (?) surprise, don't look at all.

So on to the Instructor's page, then — (press Escape if you currently have the cockpit on your screen), where there are several things to look at and possibly adjust before you get to the pretty bit:—

First of all the weather: as well as their obvious uses to tell you about wind and cloud at various stages of your flight (as discussed in the main body of the Tutorial), the Departure WXR, Cruise WXR 1 . . 3, and Arrival WXR pages can also be used to inflict as many nasties weather-wise as you or the INI creator might wish. You can change what is there if you don't like what you see: it's often useful to start with your departure weather, and once you've got the general theme worked out, copy that to all weather areas (the button in the top right-hand corner) — then tweak each of the others as required. Don't forget you are going to have to divert round severe weather, though. ☺

If you're feeling particularly masochistic, you can also go and use the options which cause planned or random malfunctions — but probably not if you've got a heart condition; and only if you really enjoy surprises in what awaits you (I would surmise that most beginners, for whom this guide is written, won't come into the latter category).

Use New position / Time to change your heading, position, or local time as you wish. Thanks once again to Jeroen Hoppenbrouwers, there is a growing Gate database to be found on the web (`http://infolab.kub.nl/people/hoppie/ps1/gates`), which is well worth installing since as well as the Gate information it provides additional ATC stuff such as whether your barometric information should be in inches Hg or millibars (hPa), and any variations to the Transition Alititudes and Levels from PS1's standard values.

Decide whether you want to work in lbs or Kg, and then make sure that the correct option is selected on the Preferences menu. In general, Europe uses Kg, whereas the US uses lbs —

but it's easiest if you simply decide once and for all which you prefer to use, and then stick with that decision.

On 'Preflight Items', you will need to set your zero fuel weight (typically, perhaps something like 494 (x 1000 lbs) or 222 (Kg)), and your fuel quantity (e.g. I find 250,000 lbs about right for a 3,500 mile trip from Heathrow to Chicago, or 25,000 Kgs OK for London to Dublin) — and don't forget to top up with hydraulic fluid and oil too, if you need any. This is also where you decide whether external power is available or you're going to use some of your precious fuel for the APU (although it's a drop in the ocean, really, compared to what is to follow).

The Air Traffic Control section is also useful to select whether you want the push back procedure (but remember, you're going to have to call that option up using the H key *before you start engines* or else it's too late). This is where you make decisions about departure and arrival routes, and speed and altitude restrictions; and also where you set your preferred airline and call sign, not forgetting the departure and destination airports, and, of course, the cruise level for ATC's benefit. If you are selecting the probability of a hold, remember that this will only work for descent along an LNAV route *where there is at least one name of less than four letters in the route.*

Using the following menu item ("First Officer"), you can set whether he handles the MCP and radios for you as directed by ATC, and whether he sets the 'Tank to Engine' when needed: he will even advise you prior to reaching specific DME altitudes for VORDME, NDB DME, or LOCDME approaches if you set them up here.

And finally — don't overlook the Airport Information option, which gives you lots of good stuff about runway lengths, radio frequencies, and ILS availability which can be very helpful. This option is very useful, especially to confirm that the information in your charts agrees with PS1's internal database [109]. The other items in the Analysis section of the Instructor's page are generally used post-flight — "post", in this case, sometimes being as in "post mortem" ☹ . But they are extremely useful, nonetheless — enabling you to look at various aspects of how you have flown. One of the most-used options is the Track Plotter: press "Reset" to start a new recording. (The maximum duration is 20 hours, and the time remaining can be viewed on the blue SIMU page reached via the MENU button on the FMC).

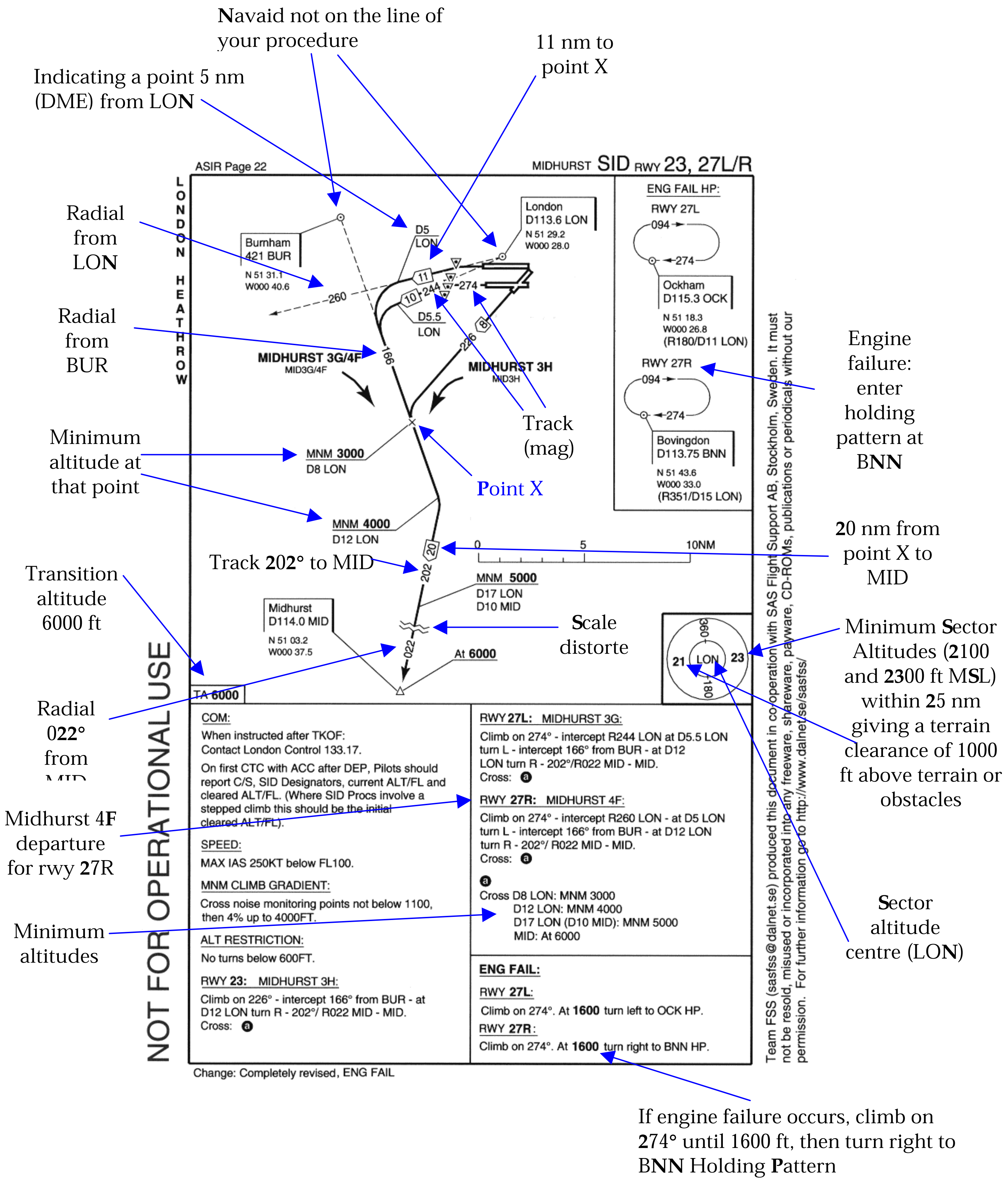
(The Instructor's page menu options are all fully described on pp 22 – 26 of the PS 1.3 manual).

---

[109] For example: the chart in Appendix 14 gives the Heathrow 09L localizer as 093°, whereas checking with the Airport Information shows that PS1 will be using 094°.

Appendix 15: Interpreting the SAS charts

Here, first of all, is a SID (from Heathrow via Midhurst, heading south) with comments:—



Navaid not on the line of your procedure

Indicating a point 5 nm (DME) from LON

11 nm to point X

Radial
from
LON

Radial
from
BUR

Minimum
altitude at
that point

Track
(mag)

Point X

Track 202° to MID

Transition
altitude
6000 ft

Scale
distorte

Radial
022°
from

Midhurst 4F
departure
for rwy 27R

Minimum
altitudes

Engine
failure:
enter
holding
pattern at
BNN

20 nm from
point X to
MID

Minimum Sector
Altitudes (2100
and 2300 ft MSL)
within 25 nm
giving a terrain
clearance of 1000
ft above terrain or
obstacles

Sector
altitude
centre (LON)

COM:

When instructed after TKOF:
Contact London Control 133.17.

On first CTC with ACC after DEP, Pilots should report C/S, SID Designators, current ALT/FL and cleared ALT/FL. (Where SID Procs involve a stepped climb this should be the initial cleared ALT/FL).

SPEED:

MAX IAS 250KT below FL100.

MNM CLIMB GRADIENT:

Cross noise monitoring points not below 1100, then 4% up to 4000FT.

ALT RESTRICTION:

No turns below 600FT.

RWY 23: MIDHURST 3H:

Climb on 226° - intercept 166° from BUR - at D12 LON turn R - 202°/ R022 MID - MID.
Cross: ⓐ

RWY 27L: MIDHURST 3G:

Climb on 274° - intercept R244 LON at D5.5 LON turn L - intercept 166° from BUR - at D12 LON turn R - 202°/R022 MID - MID.
Cross: ⓐ

RWY 27R: MIDHURST 4F:

Climb on 274° - intercept R260 LON - at D5 LON turn L - intercept 166° from BUR - at D12 LON turn R - 202°/ R022 MID - MID.
Cross: ⓐ

ⓐ
Cross D8 LON: MNM 3000
D12 LON: MNM 4000
D17 LON (D10 MID): MNM 5000
MID: At 6000

ENG FAIL:

RWY 27L:
Climb on 274°. At **1600** turn left to OCK HP.

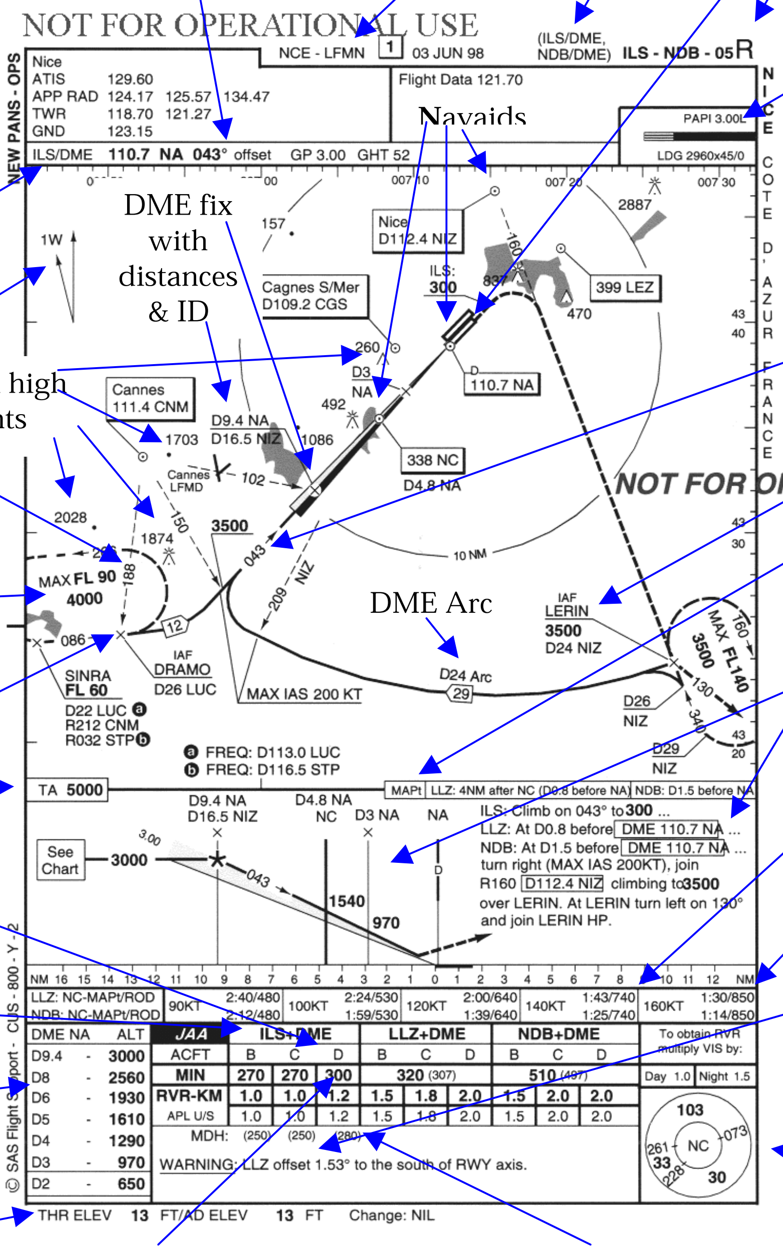
RWY 27R:
Climb on 274°. At **1600** turn right to BNN HP.

Change: Completely revised, ENG FAIL

Team FSS (sasfss@dalnet.se) produced this document in co-operation with SAS Flight Support AB, Stockholm, Sweden. It must not be resold, misused or incorporated into any freeware, shareware, payware, CD-ROMs, publications or periodicals without our permission. For further information go to http://www.dalnet.se/sasfss/

If engine failure occurs, climb on 274° until 1600 ft, then turn right to BNN Holding Pattern

And here is an ILS approach — into Nice runway 05R:—



N.B. The localizer (LLZ) is not offset in the simulation — it is in line with the runway at 45°

Airport ID

Runway 05R

Approach type

Approach lighting and available runway / slope

Navaids

Frequencies

DME fix with distances & ID

Magnetic variation

Final Approach Track 043° (045° in the sim)

Terrain high points

LERIN Initial Approach Fix

Radial 188° from CNM VOR

Missed approach points

Max and Min holding alt / FL

DME Arc

DRAMO Initial Approach Fix

Descent profile

Transition Altitude 5000 ft

Rate of descent on the localizer is 740 fpm @ 140 kts, 850 fpm @ 160 kts (groundspeed)

Aircraft categories (B747 is category D)

We use ILS+DME

(Which is why I didn't use it for the Tutorial)

Distances for the F/O to call if ILS out of service

Minimum sector altitudes

Threshold elevation (MSL)

Minimum Descent Altitude for us would be 300 ft MSL

Minimum Descent Height for us would be 280 ft AGL

Definition: "A Cat II operation is a precision instrument approach and landing using ILS or MLS with a Decision Height below 200 ft but not lower than 100 ft and with a Runway Visual Range of not less than 300 meters". Since no Cat II minima are specified here (because an Autoland with an offset localizer is not permitted) if we were carrying out a Cat D Autoland, we would need to choose a suitable Decision Height — say, 100 ft.

Appendix 16: The clock, chronograph, and elapsed time recorder

As with so many things about the 747, the clock is a simple item about which there is nevertheless a degree of confusion amongst some users of **PS**1. It is important to realise that the clock provides you with the time (obviously), and also with two quite different additional functions — elapsed time, and chronograph.

Time

The GMT / Zulu / UTC time is shown in the upper window: there isn't much else to say about that. ☺

Chronograph or 'stop watch'

The lower window contains the chronograph minutes (the sweeping hand indicates the seconds): but when the chronograph is reset, the lower window then displays the elapsed time in hours and minutes (see below). **P**lease note that the chronograph is *not for recording the elapsed flight time* — that's what the Elapsed Time function is for. In Hardy's words the chronograph or 'stop watch' is ". . . designed as a back-up for checking the 10 minute EGT limit during take-off; and for navigational purposes in specific I**F**R procedures (e.g. non-precision approaches, holds, training patters, and so on)". To start, stop, and reset the chronograph press C or click on the clock face.

Elapsed Time

This is displayed in the lower window when the chronograph is reset. To reset the elapsed time to zero, use the Ctrl + Back**S**pace key combination. **F**or safety reasons (you don't want to accidentally reset your flight time to zero whilst in the air) the *only* way to reset the elapsed time is by using that key combination — pressing C or clicking the clock face with the mouse affects **only** the chronograph (start, stop, and reset). The elapsed time function *is* intended to record your elapsed flight time, which is why you press Ctrl + Back**S**pace to reset it at the start of your take-off roll.

Index

80 kts 49, 97
A/P 49
A/T ARM 36, 92
Abnormal Procedures 44
ACARS 54, 55
ACARS REQUESTS 55
acceleration height 40, 41, 50, 97
ACT RTE 1 33
active runway 98
add your own waypoints 82
Advisory, Caution, and Warning messages.. 93
Aerodrome Forecast 56
AFDS 37, 92
AFDS Mode Control Panel 76
Aileron trim 44, 94
Air Traffic Control 153
Air Traffic Control page 20
aircraft symbol alignment, IRS check 49
Airline-specific options 19
airport elevation 37
Airport info 22
Airport Information 153
airports 153
ALT 78
ALT HOLD 78
ALT knob 79
altimeter setting 56
altimeter setting (U.S. terminology) 73
Altitude 73
altitude constraint 84
altitude constraint, first 36
altitude window, MCP 51
Altn Flaps 30
ALTN FLAPS 90
ALTN FLAPS selector 24, 88
ALTN GEAR EXTEND NOSE-BODY 30
ALTN GEAR EXTEND WING 30
amber flags, Navigation Display 37
Analysis section 153
annunciators 76
anti-collision BEACON 43, 94
anti-ice switches 68, 101
anti-icing 21
anti-icing controls 51
anti-icing switches 50, 97
APP button 66
APP mode 99
APP switch 79
Approach Briefing 60
Approach Ref page 60, 99
Approach Ref page, re-visiting 65
APU 24, 68, 69
APU bleed air switch 28, 89
APU GEN 43, 67, 94, 101
APU RUNNING 67
APU selector 46, 67, 95
APU Selector switches 69, 102
APU shutdown sequence 46
Arrival WXR page 56
ARRIVALS page 58
assumed temperature display 40
assumed temperature, de-rating by 40
ATC 43, 49, 62, 153
ATIS 31, 55, 62, 153
ATIS for EGLL 56
ATIS request 55
AUTO ignition 26, 89
Autobrake 67, 100
Autobrakes 99
autobrakes disengaged 67
Autoland 60
Automated Information 31
automatic flight 76
Automatic flight, returning to 80
autopilot 36, 92
Autopilot 67, 100
autopilot disengage bar 36, 92
Autopilot, activation of 49
AUTOSTART button 26
autothrottle 36, 92
Autothrottle 47, 96
autothrottle annunciator 76
autothrottle arm switch 67, 101
AUTOTHROTTLE mode indication 37, 92
autothrottle modes (controlling thrust) 78
autotune 34
Auxiliary Power Unit 24
AVAIL 67
backspace key, for reverse thrust 66
bank limit selector 36, 92
baro setting 59
baro setting, pre-selection of 59
barometric pressure 31, 59
Battery switch 69, 102
BATTERY switch 24, 88
beacon 67, 68, 101
Bertil Gullmar 55
best speed for the hold 64
Big Boeing FMC User's Guide 52, 83
Bovingdon 32
Bovingdon 1A STAR 32
Bovingdon 1A STAR, assignment of 55
brake release 49
brake temperatures, even distribution after landing 68
brakes 96

British Airways configuration 29
153
Bulfer and Gifford 52, 83
BUS TIE 24, 88
cabin signs 52
capture the localizer 66
carbon brakes 60
Cat II approach to Heathrow 65
caution messages 36
CDU 8, 57
CDU buttons 28
Center of Gravity 22
centre tank 74
CG value 41
Checklist, Aviaion terminology 39
checklist, BA version 38
checklist, read by First Officer 38
chronograph 162
CLB 50
climb mode 40
climb parameters 51
climb rate 51
clock 46, 162
clock, discussion in Appendix 16 49
clock, reset elapsed time 49
CMD 76
Cockpit Checklist 38
cold and dark 10
combined speed and altitude constraints 84
Comms frequency windows 30
Company Route 31
CON IGN EICAS message 52
CONFIG GR OVRD 30
constraints 42
Continue Flight option 18
continuous ignition 62, 68, 99
Continuous Ignition 26, 89
Continuous Ignition, automatic activation 51
control deflections, verifying 47
cost index 54
COST INDEX 34, 54, 91
crew briefing, take-off and departure 44
crossfeed switches 38
Cruise 53
cruise altitude 53, 97
cruise level 153
cruising altitude, optimum 53
CRZ ALT 34, 91
cutoff, fuel switches to 68
Deans Cross 31
deceleration 61
Decision Height 35, 60, 61, 66, 71
Decision Height display 35
DEP/ARR 32
Departure 50, 97
departure airport 31
Departure frequency 43
departure runway 31
departures 32
Descent Forecast page 59
descent profile 61
deviation pointer 62
DH 35, 60, 71
discharge light 26
discontinuity 34, 58
disengage LOC mode 79
disengaging APP mode 80
distance to T/D 53
distance to T/D, monitoring 60
DME 66
dozin' for dollars 54
DRS 43, 44, 68, 94, 95, 101
dry 41
duct pressure 28
duct pressures for engine start 44
ECON CRZ 53
ECS synoptic display 27
EFIS control panel 8
EFIS controls 19
EGLL ARRIVALS 57
EGT 45
EICAS 8
EICAS display selector 27, 89
EICAS RCL button 55
elapsed time recorder 162
ELEVator mode 44
EMER LIGHTS switch 25
emergencies, QRH for 44
ENGINE BLEED air 28
Engine bleed SYS FAULT lights 28, 89
Engine indications, monitoring during start 46
engine start, manual 45
ENGINE STARTER switches 45, 95
ENTER IRS POSITION 29
EQUIP COOLING 27, 89
equipment cooling selector 68
EXIT ARMED 65
EXIT HOLD 65
EXT PWR 88
exterior lights 68, 101
External data link 21
Farnborough 6
FD 76
Ferry round the M25 12
FERRY13.INI 12
FF indicator 45
Final Approach Fix 100
fire handles, checking 25
fire protection, APU 69
FIRE TEST PASS 25
Fire/eng test switch 25
First Officer 153
flap lever 24, 88
flap limiting speeds 110

flap manœuvring speeds 110
Flap manœuvring and placard speeds 110
flap override 90
Flap Override switch 30, 90
FLAP OVRD 30
flap retraction complete 50
flap retraction sequence, starting 50
flap retraction speeds 50
FLAP/SPEED line 60
flaps 67, 96
FLCH SPD 78
flight director 50
Flight Director 36, 92
Flight Director switch 67
Flight Director, manual take-off 50
Flight Management Computer 19
flight modes 76
FMC 10, 19, 54, 89
FMC position & ground speed check 37
FMC, entry of TAI 57
forecasted winds, descent, entry of 59
forecasted winds, entry of 53
forum, Aerowinx 7
forward and aft override pump pressure lights
.... 27
FreeWare 5
freeze 10
FREEZE folder 9
FSMCs 74
fuel control switches 36, 92
FUEL CONTROL switches 45, 95
FUEL JETTISON 26, 89
Fuel management 74
FUEL OVRD CTR 74
FUEL PMP STAB 74
fuel pump override switches 68, 101
fuel pump switches 68, 101
FUEL PUMP switches 27
Fuel Quantity 22
fuel switches 68, 101
FUEL synoptic display 38
Fuel System Management Cards 74
FUEL TANK/ENG 74
FUEL XFER MAIN 1+4 25
FuelPlan 34, 156
full alignment of IRS 25
full IRS alignment 29
G/S annunciated 66
G/S INHIBIT switch 29
Gate database 152
Gatwick 12
gear display 50
gear hydraulics depressurisation 50
gear override 30
gear retraction 49
gear retraction indications 49
gear to OFF 50
GEN CONT switches 35, 91
glareshield buttons 19
Glideslope 60
GMT 162
go-around 61
GOWLHR13 .... 18, 21
GPWS gear override 20
green band, Stabilizer Trim 44
gross weight 39, 93
Gross Weight figure 39
Ground frequency 37, 43
Ground Proximity Flap Override 30, 90
Ground Proximity panel 29
handbrake 48
hardware throttles 67
Hardy Heinlin 6
HDG HOLD 77
HDG SEL 77
Heading 73
heading knob, agreement with ND course 50
Heading Reference 37, 92
heading up 107
Headwind or Tailwind 41
Height 73
height restrictions (LEGS) 84
HI FLOW 27, 89
hold 63
Hold page 63, 64
HOLD, annunciation on PFD during take-off
.... 49
hold, best speed for 64
holding speed, London TMA 63
Honiley 31
hydraulic demand pump 4 .... 46, 95
Hydraulic Demand Pump 4 .... 43, 94
hydraulic demand pump selectors 24, 88
hydraulic engine pump switches 35
HYDRAULIC quantities 30
ICAO code 31
62
IDENT page 29
IGNITION CON 26
ILS approach 66
ILS frequency 59
ILS identifier 66, 99
inboard landing lights 50
Inertial Reference System 25
INIT REF 28, 37, 39, 89, 92, 93
Instructor's page 152
Instructor's Page 20
Instructor's Page, returning to 22
INSUFFICIENT FUEL 34
IRS 25
IRS error check 68
isolation valve switches 28, 89
joystick 47
JUMP TO 53

keep current configuration ... 21
Kg ... 152
L and R isolation switches ... 68
L ISLN ... 28, 89
LAND2 ... 76
LAND3 ... 76
Landing ... 67
landing altitude, displayed on EICAS ... 59
landing gear lever ... 24, 88
landing lights ... 35, 67, 101
Landing Lights ... 52, 97
landing lights, setting on ... 47
landing lights, setting ON during descent ... 64
lapse rate ... 21
latitude and longitude waypoints ... 82
layout, Tutorial ... 8
lbs ... 152
Leaving the Aircraft ... 68
Leaving the Runway ... 67
LEGS ... 82
LEGS page ... 33
Line up and hold ... 47, 48
LNAV ... 42, 49, 50, 66, 76, 94
LNAV, returning to ... 80
L-NOZZLE-R ... 26
LOC button ... 66
LOC mode ... 66
LOC switch ... 79
localizer ... 79
Localizer mode ... 66
London Control ... 55
lower EICAS ... 19
lower EICAS Status messages ... 38
L-UTILITY-R switches ... 35, 91
MAG ... 37
Main FUEL PUMPS ... 38, 93
Main Pump PRESSure lights ... 27
Main tanks 1-4 ... 74
malfunctions ... 7, 20
manual speed/altitude restriction ... 42
MAP ... 34
max motoring speed, starter motor ... 45
MCP ... 8, 41, 42, 51, 62, 99
MCP altitude ... 100
MCP controls ... 19
MCP heading bug ... 100
MCP speed ... 100
MDA ... 35, 60, 71
MDA button ... 35
MENU ... 54
METAR ... 103
Microsoft ... 7, 69
Minimum Descent Altitude ... 35, 60, 71
Minimum Equipment List ... 38
Minimum Safe Altitude ... 60
missed approach altitude ... 66
missed approach procedure ... 61
Mouse usage ... 72
N1 limits ... 40
Nacelle anti-ice ... 35, 46, 91, 95, 100
Nacelle Anti-Ice ... 56
Nacelle anti-ice switches ... 68, 101
nacelle anti-icing ... 51
NAI ... 51, 56, 57, 63
NAV RAD ... 34
Nav Rad FMC page ... 59
Navigation Display ... 18
Navigation Lights ... 35, 91
ND ... 8
ND mode selector ... 33
New Galloway One Juliet SID ... 31
next waypoint ... 53
NGY1J departure ... 32
NO AUTOLAND ... 76
no smoking ... 52
No Smoking ... 94
NO V SPD ... 37
noise abatement ... 41
NOTAMS ... 20
nozzle valve switches ... 26, 89
OAT ... 40
off block time ... 46
OM ... 62
optimal climb thrust de-rate ... 40
outboard landing lights ... 96
Outboard Landing Lights ... 99
62
OUTFLOW VALVES ... 89
Outside Air Temperature ... 40
override pump switches 2 and 3 ... 38
OVRD ... 30
oxygen pressure ... 30
PACK control selectors ... 28, 89
PACK RST ... 27
pack selectors ... 69
Pack selectors ... 46, 95
packs ... 50, 68
PACKS ... 43, 47, 94, 96
Pack's Reset Switch ... 27, 89
panel layout ... 18
PARK ... 34
Parked frequency ... 34
Parking and shutdown ... 68
parking brake ... 36, 68, 101
Parking Brake ... 43
PAUSE control ... 18
PERF INIT ... 34
PFD ... 36, 37, 42, 49, 50, 51, 92
pitch mode annunciator ... 76
Pitch mode annunciator ... 37
Pitch mode TO/GA ... 77
pitch modes ... 77
placard speed (flap) ... 111
place bearing/place bearing waypoints ... 83

place/bearing/distance waypoints ... 82
PLN ... 33
PLN mode ... 58
POS ... 68
POS INIT ... 28
positive rate of climb ... 49
preferred airline ... 153
Pre-flight ... 56
pre-flight information, gathering ... 20
pre-flight preparation ... 152
PRESSure fault ... 35, 91
Primary Flight Display ... 12, 18
PROG ... 53
PS1FPLAN ... 156
pump pressure lights ... 27
pushback and start clearance ... 43
PVD ... 35
QNH ... 31, 43, 59, 60, 62, 73
QuickReferenceHandbook ... 44
R ISLN ... 28, 89
Radio Altitude ... 35
random switch positions ... 22
rate of climb ... 51
RCL ... 99
RCL button ... 53
received MESSAGES ... 54
recirculation fan switches ... 27, 89
ReFill ... 30
reserve wing tanks ... 74
RESERVES ... 34, 91
Resume own navigation ... 80
reverse thrust ... 66, 67, 100
roll mode annunciator ... 76
Roll mode annunciator ... 37
roll modes ... 77
Rolls Royce RB-211 engines ... 29
Rotate ... 49
route ... 154
route discontinuity, resolution of ... 58
route discontinuity' ... 58
Route Offset ... 54
RoutPlan ... 154
RST ... 60
RST button ... 35
RTE ... 37
RTE button ... 31
RTE DATA ... 52, 53
RTE LEGS ... 85
RTO (Reject Take-Off) position ... 29
rudder pedals ... 50
Rudder trim ... 44, 94
runway condition ... 41
runway heading ... 36, 59, 92
runway in use ... 31, 62
runway length ... 41
runway Upslope or Downslope ... 41
SAS charts ... 55
SAT ... 40
SCT files ... 47
seat belt ... 52
seatbelt ... 43, 60, 68, 94, 99, 101
secondary ENGine display ... 44
shutdown sequence ... 46
SID ... 85
SIM STATUS ... 53
situation ... 10, 152
Situation ... 9
small font ... 42
small fonts ... 84
  153
SPD RESTR ... 61
SPD switch ... 79
speed bug ... 50
speed constraint ... 84
Speed control, FMC reassuming ... 80
Speed Intervention ... 65
Speed Limit Point ... 62
Speed mode ... 79
speed restriction information, entry into DES page ... 61
speed restrictions (LEGS) ... 84
speed restrictions, VNAV page ... 42
speed/altitude restriction ... 42
speedbrake ... 67, 100
speedbrake lever ... 36, 92
speedbrakes ... 67, 101
speedbrakes, not using ... 62
speeding the flight ... 53
squawk ... 43
STAB trim mode ... 44
stabiliser pump pressure lights ... 27
stabiliser tanks ... 74
Stabiliser Trim ... 44, 94
Stabilizer Trim ... 67
stabilizer trim indicator ... 36
stabilizer trim units ... 41
standby ignition ... 26, 89
standby instrument display ... 22
Standby power selector ... 69, 102
STANDBY power selector ... 24, 88
Stanley Stewart ... 57
STAR ... 85
START knobs ... 26
start switches ... 89
starting the engines manually ... 45
STAT ... 47, 67
STAT synoptic's APU EGT figures ... 24
Static Air Temperature ... 40
status messages ... 30
STBY ... 26
STD altimeter ... 51
STD button ... 59
steering pin ... 43
Steering Tiller ... 46

STEP ... 33
step climb ... 53
storm cells ... 54
strobe lights ... 47, 96
strobes ... 67, 101
synoptic views ... 19
SYS FAULT ... 35, 91
T/C ... 51
TA ... 73
TAF ... 56, 103
TAI ... 21, 59
TAI ON altitude ... 59
Taipei to Guam videos ... 10
Take-off ... 49
takeoff clearance ... 48
take-off clearance, awaiting ... 48
takeoff flap setting ... 40
take-off flap setting ... 41
take-off Flaps, setting ... 47
takeoff N1% thrust ... 40
Takeoff page ... 39, 40
TAT ... 40, 56
taxy ... 46
Taxy clearance ... 46
taxying technique ... 46
Team **FSS** ... 55
TELEX ... 54
THR mode ... 79
THR REF mode ... 49, 78
THR switch ... 78
threshold ... 47, 96
throttle ... 49, 96
throttles ... 36, 92
THRUST LIM page ... 39
thrust mode ... 40
Thrust mode ... 78
thrust reduction height ... 40
TL ... 65
TO ... 39
TO/GA ... 49, 96
TO1 ... 39
TO2 ... 39
TOGA ... 66
Top Of Climb ... 51
Top Of Descent ... 62
Tower frequency ... 43
towing system ... 43
Track ... 73
track up ... 107
TRANS ALT ... 41
Transition Altitude ... 41
Transition altitude ... 51, 97
Transition Altitude ... 73
Transition Level ... 56, 59, 62, 65, 73
TRIM AIR ... 27, 89
TRN 020 radial ... 50
TWY utility ... 47
UNABLE CRZ ALT ... 34
UNABLE NEXT ALT ... 33, 34
units, Stabilizer Trim ... 44
unprepared cockpit ... 22
upper EICAS ... 18
Upper EICAS caution messages, removal of. 44
UPR-RECIRC-LWR ... 27
UTC ... 162
V speeds, confirmation of ... 41
V speeds, not present ... 41
V/S ... 78
V1 ... 49
V2 ... 42
V2+10 ... 42
VALVE lights ... 26
Video ... 8
VNAV ... 41, 42, 49, 50, 77
VNAV ALT ... 77
VNAV deviation pointer ... 62
VNAV PTH ... 77
VNAV SPD ... 77
VNAV, returning to ... 80
VOR beacons ... 34
V_{REF} ... 60, 65
WAI ... 51, 56, 57
WAI, Auto option with BA config ... 57
waypoint naming convention ... 61
waypoint winds ... 52
waypoints ... 33, 36
waypoints of your own ... 82
weather ... 54, 152
Weather ... 21
47, 67, 101
weather radar, turning on ... 48
WEATHER request ... 55
wet ... 41
wind information, for descent ... 55
Wing anti-ice ... 91
Wing Anti-Ice ... 56
Wing anti-ice switches ... 68, 101
WPT EDITOR ... 82
WXR ... 54, 152
WXR button ... 48
Z key ... 153
zero fuel weight ... 153
Zero Fuel Weight ... 22, 39
ZFW ... 22
Zulu ... 162